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SIMM (K.). **Einige Beobachtungen über die Halmfliege** (*Chlorops pumilionis* **Bjerk.).** [A few Observations on the Stem Fly, *C. taeniopus*, Mg.] [*In Polish.*]—*Mém. Inst. polon. Écon. rur.* **15** fasc. 1 pp. 59–77, 14 refs. Puławy, 1934. (With a Summary in German.) [Recd. 1936.]

Chlorops taeniopus, Mg. (*pumilionis*, Bjerk.) had three generations on wheat in Polish Silesia in 1925. The overwintering larvae pupated in the second half of April and beginning of May, and the adults were on the wing till June ; adults of the first and second generations appeared in late July and late September ; and larvae of the third generation occurred in October and hibernated.

Observations showed that the severity of infestation depends to a great extent on climatic conditions, especially at the time of oviposition of the adults of the overwintered generation. If the weather is cool, rainy and windy, the flies remain inactive on the plants close to the surface of the soil and lay only a few eggs. Instances are cited in which the number of flies present in the spring appeared to be in inverse ratio to the degree of subsequent infestation of wheat. Infestation was more severe in varieties of wheat that developed shoots late or remained soft and tender for a long period ; early sowing in the autumn and spring would therefore safeguard the crop from infestation, as was confirmed by observations in 1931. Wheat growing in moist soil was more severely infested, because the tissues did not harden for a longer period. The application of fertilisers containing potash and phosphates raises the power of resistance of the plants by accelerating the hardening of the tissues. Sowing trap belts of summer wheat about 40 ins. wide round fields of autumn-sown wheat provided successful protection.

The effect of infestation on the yield of wheat and straw is discussed. Early infestation of the stems reduces or inhibits the production of ears. The infested stems are short and thick at the lower end. The reduction in weight of grain from them varied from 1·7 to 21·8 per cent., being much greater when the stem was infested before the ears had emerged from the leaf-sheath. The weight of the straw is often increased by infestation as it is coarser and thicker, though very brittle.

NEISWANDER (R. B.). **Oriental Fruit Moth Investigations in Ohio. II.** —*Bull. Ohio agric. Exp. Sta.* no. 569, 30 pp., 7 figs., 17 refs. Wooster, Ohio, June 1936.

A survey is made of the work on the oriental fruit moth [*Cydia molesta*, Busck] carried out in Ohio in the years 1930–36. Much of the information has already been noticed [*R.A.E.*, A **18** 38, 550 ; **19** 434 ; **20** 320 ; **21** 230 ; **22** 536 ; **24** 91].

The following is taken from the author's summary : The time of emergence of the moths of the overwintered brood varies with temperature but corresponds with the blooming period of the peach. Fruits and twigs of peach and apple, fruits of quince, pear and plum, and twigs of sweet cherry are attacked. Larval mortality varies with the hardness of the peach fruit in which the larvae feed. Natural mortality is low early in the season when the peach is growing rapidly, high in mid-season while the stone is hardening, and low again when the peach swells before ripening. Eight counts of infestation made in one orchard during three successive seasons have shown, across the orchard, an unequal but consistent distribution of infestation which has not been

(2174) Wt. P15/3619 1700 12/36 S.E.R. Ltd. Gp. 353. [A]

accounted for. One side was consistently most heavily infested. Approximately 25,000 individuals of *Macrocentrus ancylivorus*, Rohw., have been released in Ohio. This parasite has multiplied rapidly in northern Ohio and is largely responsible for a significant reduction in injury by the fruit moth in that part of the State. Eight species of foreign parasites have been introduced into Ohio, but as yet none has become established. Native parasite species have become sufficiently abundant in central and southern Ohio to suppress the fruit moth population. Several of the more important fruit moth parasites are known to attack the ragweed borer, *Epiblema strenuana*, Wlk., and the strawberry leaf-roller, *Ancylis comptana*, Froel., both of which are generally distributed in Ohio. These parasites, therefore, should be able to survive during periods when fruit moth larvae are scarce. Damage by the fruit moth in the whole of Ohio probably reached a peak in 1931, since when the injury has been decreasing, probably because of parasites ; in 1935 it was relatively light in most orchards.

Service and Regulatory Announcements, January-March 1936.—*S.R.A., B.E.P.Q.* no. 126 pp. 1–40. Washington, D.C., U.S. Dep. Agric., June 1936.

In addition to other announcements relating to plant quarantines in the United States, one relating to Quarantine no. 52 approves two alternative methods for the treatment of baled cotton lint moved from areas heavily infested with the pink bollworm [*Platyedra gossypiella*, Saund.]. Baled lint has hitherto been given both vacuum fumigation [*R.A.E.*, A **14** 300] and either compression or roller treatment [*cf.* **15** 669]. In future the flat bale may be subjected to a steam pressure of not less than 15 lb. per sq. in. for not less than 3 minutes at a temperature of not less than 150°F. at a depth of 3 ins. from the surface of the bale at all points, provided that this treatment is followed by standard or high-density compression. Alternatively, the lint of such bales may be passed between revolving rollers that are of adequate weight and set sufficiently close to crush all cotton seed and kill all pink bollworms present. The premises and the coverings of the bales must be uncontaminated, and the bales must be moved directly from the press to a situation adequately safeguarded against contamination.

Notice of Quarantine no. 37 relating to the importation from abroad of nursery stock, plants and seeds [*cf.* **15** 390 ; **23** 237, etc.] is reprinted, with its revised regulations and appendices. Plant quarantine restrictions in New Zealand, Chile, Argentina, Czechoslovakia, Palestine, Luxembourg, Sierra Leone and the Gold Coast are quoted or summarised.

Risbec (J.). **Les parasites du cocotier en Nouvelle Calédonie.**—*Agron. colon.* nos. 221–222 pp. 140–152, 169–188, 1 pl., 43 figs., 3 refs. Paris, May–June 1936.

Descriptions are given of the principal insect pests of coconut in New Caledonia, with notes on their bionomics. They include *Agonoxena* sp. [*cf. R.A.E.*, A **19** 734] and *Diocalandra* (*Calandra*) *taitensis*, Guér., which is liable to cause serious damage as it does in the New Hebrides [*cf.* **23** 548]. The larvae of *Tirathaba rufivena*, Wlk., feed chiefly on the male flowers, but also attack the bases of twigs bearing the fruit and of the young nuts, causing the latter to fall prematurely. Damage caused in this way is considerable, but is often overestimated by being

confused with the natural fall of the nuts. The larvae generally leave the nut before it falls, and pupate amongst the débris of the male flowers, the pupal stage lasting about 3 weeks. *Aspidiotus destructor*, Say, is widely distributed and attacks nearly all palms of all species on the Island. It weakens the coconut palms, but is prevented from becoming very injurious by natural enemies, the most important being an Aphelinid parasite, which is briefly described. *Aleurodicus destructor*, Mackie, which is found with *Aspidiotus* on the leaves, is neither common nor very injurious. *Aleurocanthus* sp. occurs in small colonies, but does little damage, possibly because it is attacked by a fungus. *Brontispa froggatti*, Sharp, has attacked all species of palms severely in the last few years, both in the extreme north and south of the Island, but not intermediately (a distribution complementary to that of *Plesispa cocotis*, Maulik). It causes a decrease or cessation of fruit production, and sometimes the death of the tree. The adults occasionally extend infestation by flight. Removal of the central leaves of infested palms is recommended for control [*cf.* **17** 416]. *P. cocotis*, which is distributed over most of the Island, has similar habits, but apparently does less damage, and penetrates less deeply into the centre of the foliage. Tables are given showing the characters distinguishing *P. cocotis* from *B. froggatti* and from *B. sarasini*, Heller, a Hispid that probably lives on palms but has never been reported from coconut.

[Yakhontov (V. V.).] **Яхонтов (В. В.). Contribution to the Biology and economic Importance of the Beetles of the Genus *Sitona* Germ. Pests of Lucerne in Central Asia.** [*In Russian.*]—*Sotz. Nauka Tekhn.* **3** no. 11 pp. 53–59, 3 figs., 1 graph, 5 refs. Tashkent, 1935. [Recd. 1936.]

The species of *Sitona* that infest lucerne in Central Asia are *S. callosa*, Gyll., *S. crinita*, Hbst., *S. cylindricollis*, Fhs., *S. humeralis*, Steph., and *S. longula*, Gyll. The first four of these were observed near Tashkent (eastern Uzbekistan) in 1933–35, and some notes on their bionomics are given. Repeated examinations in 1934 showed that by the middle of June up to 87·5 per cent. of the nodules of the lucerne plants had been destroyed by the larvae. The adults can be observed throughout the year; in winter they shelter in cracks of the soil and under vegetable matter, but feed and pair if a spell of warm weather occurs. Recently deposited eggs were found in the field on 17th February, and oviposition by overwintered females of *S. cylindricollis*, which was the most abundant species, continued until late June in the insectary under conditions of temperature and humidity approaching those in the field. Some of the females laid over 1,000 eggs each, at the rate of 2–47 per day. Maximum oviposition occurred in May. Eggs were found on the surface of the soil, and very rarely on the leaves of lucerne. Eggs kept in the shade hatched in 17–39 days in February–April. Young larvae placed on the soil immediately entered it; those kept exposed refused to feed. Young adults of the new generation, that had not yet left the soil, were found in the second half of June. To destroy the hibernating weevils, all vegetable matter in the lucerne fields should be burnt in winter and they should be disked early in the spring. These measures are also of value against *Hypera* (*Phytonomus*) *variabilis*, Hbst., and the burning against the Capsid, *Adelphocoris lineolatus*, Goeze, both of which attack lucerne. Insecticides should be applied when the lucerne is sprouting in spring and the weevils have just begun to oviposit.

[Kayumov (S. R.).] **Каюмов (С. Р.). Tests against Cotton Pests of some Plants that produce Essential Oils.** [*In Russian.*]—*Sotzial. Nauka Tekhn.* **4** no. 1 pp. 33–45, 8 figs., 20 refs. Tashkent, 1936.

A detailed account is given of laboratory investigations carried out in 1935 in Tashkent on the possibility of using essential oils obtained from plants against pests of cotton. Oils of *Ocimum basilicum, Satureia hortensis, Dracocephalum moldavica, Mentha sylvestris, Pelargonium roseum* and *Salvia sclarea* were applied as sprays in concentrations varying from 0·5 to 2 per cent., on cotton plants infested with *Tetranychus telarius*, L. (*althaeae*, v. Hanst.) or *Aphis gossypii*, Glov. The oil of *O. basilicum* gave irregular results, but the toxicity of all the other oils increased with the concentration in the spray. At 0·5 per cent., oil of *P. roseum* was the most effective against *T. telarius*, killing 38·5 per cent. ; at 2 per cent. the highest kill, averaging 70·5 per cent., was obtained with oil of *S. sclarea*. This oil was not tested on *A. gossypii*, and the highest rate of mortality, averaging 50 per cent., was obtained with that of *P. roseum* at 2 per cent. On the whole, the relative toxicity of the oils was the same for both pests. Further tests with *A. gossypii* showed that the oils also had a repellent action.

Small potted cabbage plants infested with *Brevicoryne brassicae*, L., were covered with bell glasses, and a piece of filter paper impregnated with a few drops of one of the oils tested was introduced under each. All the oils produced a high rate of mortality of the Aphids, ranging from 55 to 100 per cent., when only 9 drops were used, but slightly scorched the plants. When 27 drops were applied, oil of *D. moldavica* killed 91 per cent. of the Aphids and the other oils 100 per cent. The plants, however, were badly injured and eventually died.

To ascertain whether cotton pests can breed on plants that yield essential oils, *M. sylvestris, Artemisia absinthium* and several species of *Ocimum* were artificially infested with *A. gossypii, A. laburni*, Kalt., and *T. telarius*. The rate of mortality of the three pests was very high on these plants, whereas it was low on cotton used as a control.

[M. R.] **M. P. Protection of Cotton from Diseases and Pests.** [*In Russian.*]—*Sotzial. Nauka Tekhn.* **4** no. 2 pp. 106–107. Tashkent, 1936.

Very brief notes are given on work carried out by the Central Asiatic Institute of Plant Protection in 1935. Sodium fluosilicate was almost as effective as calcium arsenate when used as a dust against the bollworm [?*Heliothis armigera*, Hb.] and did not injure the cotton plants. Measures against the red spider [*Tetranychus*] on weeds reduced the infestation of cotton and increased the yield.

Werneck (H. L.). **Eine neue Krankheit und ein neuer Schädling an der Weberkarde in Oberösterreich.** [A new Disease and a new Pest of the Teasel in Upper Austria.]—*Neuheiten PflSch.* **29** no. 4 pp. 137–138. Vienna, August 1936.

Teasels [*Dipsacus fullonum*] in Upper Austria were attacked in 1936 by *Cnephasia wahlbomiana virgaureana*, Tr., the larvae spinning together the young leaves of the shoots and eating the heart and main shoots within.

FULMEK [L.]. **Aus dem entomologischen Laboratorium der Bundesanstalt für Pflanzenschutz in Wien.** [A Note from the Entomological Laboratory of the State Institute for Plant Protection in Vienna.] —*Neuheiten PflSch.* **29** no. 4 pp. 138–139. Vienna, August 1936.

The Pteromalid, *Asaphes vulgaris*, Wlk., was bred in 1936 from leaf Aphids infesting apple in Carinthia (Austria). A list is given of the Aphids from which it has been recorded in Europe.

Eggs of *Polia oleracea*, L., were found on apple, and adults were obtained by rearing the larvae from them on apple leaves. *Robinia pseudacacia* is the only tree on which this Noctuid has been recorded.

MAYER (K.). **Bekämpfung der Rübenwanze durch Fangstreifen.** [The Control of the Beet Bug by Trap Strips.]—*Mitt. f. Landw.* **51** pp. 331–332, 6 figs. [Berlin] 1936. (Abstr. in *Neuheiten Pfl.Sch.* **29** no. 4 p. 156. Vienna, August 1936.)

The only practical means of preventing injury by *Piesma quadrata*, Fieb., to beet grown for seed production in Germany is by trap strips of beet ploughed under after the bug has migrated to them. The seed beets can be set in the field within the strips as soon as the seedlings have appeared, as the bugs always prefer seedlings to older plants. Control is not obtained by this method, however, if the bugs have opportunities for breeding on spinach.

DREXLER (H.). **Blausäurevergasung gegen** *Aspidiotus britannicus.* [Fumigation with Hydrocyanic Acid Gas against *A. britannicus.*] —*Gartenztg österr. Gartenbauges.* 1936 p. 27. (Abstr. in *Neuheiten PflSch.* **29** no. 4 p. 156. Vienna, August 1936.)

Fumigation with hydrocyanic acid gas freed from *Aspidiotus britannicus*, Newst., trees of *Prunus laurocerasus* kept indoors as ornamental plants in Vienna.

SAPPOK (H.). **Kampf dem Rapsglanzkäfer!** [Control of *Meligethes aeneus.*]—*Mitt. f. Landw.* **51** pp. 270–271, 4 figs. Berlin, 1936. (Abstr. in *Neuheiten PflSch.* **29** no. 4 p. 160. Vienna, August 1936.)

If the main flight of *Meligethes aeneus*, F., coincides with formation of the buds of rape, the rape is destroyed. It is therefore necessary to accelerate bud formation by abundant manuring and by ensuring a dense growth, as isolated plants form side shoots and are therefore longer exposed to danger. For this reason in Holstein the seed is sown broadcast instead of being drilled.

ESCHERICH (K.). **Fortschritte der Forstentomologie.** [Advances in Forest Entomology.]—*Arb. physiol. angew. Ent. Berl.* **3** no. 3 pp. 183–186. Berlin, 15th August 1936.

For about a century, forest entomology developed on the lines indicated by Ratzeburg, the work being mainly confined to studies of the morphology and biology of the various pests. During the past decade, the physiology of the species and the relation of the latter to environment have been the chief objects of attention [*cf. R.A.E.*, A

24 623], the information previously accumulated providing the basis for this new development. A brief outline of work on the nun moth [*Lymantria monacha*, L.] in Germany is given as an illustration.

EIDMANN (H.). **Die Nonne in Ostpreussen. Ein Beispiel moderner Organisation eines forstlichen Grossschädlingsproblems.** [The Nun Moth in East Prussia. An Example of a modern Organisation for studying the Problem of a major Forest Pest.]—*Arb. physiol. angew. Ent. Berl.* **3** no. 3 pp. 208–217. Berlin, 15th August 1936.

The existing serious outbreak of the nun moth [*Lymantria monacha*, L.] in East Prussia began in 1933, and in 1934 severe injury was caused in many places, especially in the spruce forests covering about 62,000 acres at Rominten. Various investigations, divided among several workers, were made there, and the author describes the organisation adopted and the chief results obtained. Some of the published results have already been noticed [*R.A.E.*, A **23** 623; **24** 339, 404, 536], and others are the subjects of the three next abstracts. For forecasting abundance, Wellenstein worked out a method of counting and classifying the pupal cases that enables the proportion of females and the amount of parasitism to be ascertained and, by means of special measurements of the cases, the number of eggs to be predicted. The forecast chart that was thus drawn up served as the main basis for the application of control. In the course of a discussion, E. Janisch pointed out that careful scientific investigations should be made at the very beginning of an outbreak, or rather that they should be carried on permanently, even at periods when no danger is evident.

BRANDT (H.). **Ueber die Aenderung des Geschlechtsverhältnisses bei Insekten und ihre Ursachen.** [On the Variation in Insects of the Proportion of the Sexes and its Causes.]—*Arb. physiol. angew. Ent. Berl.* **3** no. 3 pp. 218–221. Berlin, 15th August 1936.

The factors that lead to a variation in abundance of an insect pest may include some that pertain to the insect itself. The most important of such endogenous factors would be an increase or decrease in fertility and a change in the proportion of the sexes. The latter would seem to be influenced by population density, hunger or climate. In the nun moth [*Lymantria monacha*, L.] the normal proportion is about equal. The rudiments of the genital organs have characteristic differences, visible under the microscope, in first-instar larvae. In experiments at 20 and 33°C. [68 and 91·4°F.] with 30 and 100 per cent. relative humidity, there was greater mortality among the females than among the males. Any deviation from the optimum, such as hunger, high temperature and low humidity, caused a higher mortality of the female larvae. It is necessary to ascertain whether this is always the case with the nun moth, which involves continuous observation instead of work merely at the period of an outbreak.

HUNDERTMARK (A.). **Die Orientierung der Eiraupen der Nonne, *Lymantria monacha* L.** [The Orientation of First-instar Larvae of the Nun Moth.]—*Arb. physiol. angew. Ent. Berl.* **3** no. 3 pp. 221–226, 2 figs. Berlin, 15th August 1936.

A detailed account is given of experiments to ascertain the conditions influencing directional movement in first-instar larvae of *Lymantria*

monacha, L. With columns painted in a range of shades from white to black, the larvae moved mostly to the columns most different in brightness from the background, columns darker than the background being preferred. As a rule the larvae ascended columns that were darker than the background and seldom those that were lighter. As regards colour, it was found that orange, yellow and green were repellent, that blue green was neither attractive nor repellent, and that ice blue, blue and violet were attractive. As regards shape, the larvae preferred a triangular surface standing on its base to a similar surface standing on its apex. In the case of rectangles of equal height, narrow ones were preferred to wide ones.

v. Finck (E.). **Untersuchungen über das Auftreten der Tachine *Parasetigena segregata* Rond. während einer Nonnenkalamität.** [Investigations on the Occurrence of the Tachinid, *Tricholyga segregata*, during an Outbreak of the Nun Moth.]—*Arb. physiol. angew. Ent. Berl.* **3** no. 3 pp. 226–229. Berlin, 15th August 1936.

Parasitisation of *Lymantria monacha*, L., by *Tricholyga* (*Parasetigena*) *segregata*, Rond., was studied in areas near Rominten, East Prussia, where it had been injurious the preceding year. The adult Tachinids emerged in late May and the first half of June, the males about a week before the females. The sexes were almost equally represented. At this time the larvae of the moth were in the first three instars. Most of the females were fertilised within a few hours of emergence and then became scarce. The males were present during a period of 41 days, after which no more adults were seen. From estimates of the relative abundance of the Tachinid and of pupae of the moth, it is concluded that the former sometimes exercised real control, and if this proves to be the case in future, investigations on it may be recognised to be of value.

Eidmann (H.). **Zur Frage der Blattwespen-Prognose.** [The Forecasting of Sawfly Abundance.]—*Arb. physiol. angew. Ent. Berl.* **3** no. 3 pp. 229–234. Berlin, 15th August 1936.

In 1935 *Diprion pini*, L., defoliated pines in various parts of Prussia. The injury it causes usually has no permanent effect on the trees, but it appeared likely to be serious on pines planted on coastal sand dunes to anchor the shifting sand, on account of their poor condition. Counts of the cocoons were therefore made to ascertain the variation in abundance of the sawfly. It was found that 63 per cent. of the pupae were females and that the co-efficient of increase for 1936 as compared with the spring of 1935 was very high, though biotic factors had destroyed 51·7 per cent. of the cocoons collected. Of these, 83·7 per cent. had been destroyed by predators, 4·6 per cent. by parasites and 11·7 per cent. by diseases. Only 70 per cent. of the cocoons gave rise to adults in spring; the others contained prepupae that remained in diapause. The stands concerned were treated by means of power dusters with contact poisons suitable for hairless larvae. These insecticides do not affect the May shoots, which are necessary for the recovery of the pines and are not attacked by the sawfly, and, though they act more slowly, they are therefore preferable to the new dusts used against *Lymantria monacha*, L. [*cf. R.A.E.*, A **24** 517].

ESCHERICH (K.). **Die Erforschung der Waldverderber. Drei Jahrzehnte im Kampf gegen Forstschädlinge. Rückblick und Ausblick.** [Research on Forest Pests. Three Decades in Work against Forest Pests. A Retrospect and Prospect.]—24 pp. Berlin, P. Parey, 1936. Price *Rm.* 1.

In this booklet, which is intended also as an introduction to ecology, the author describes the development of work against forest pests during the past thirty years, and indicates the need for studying the problem of rendering forests resistant to attack. For instance, in mixed stands there is less opportunity for serious loss, as the increase of a pest is subject there to adverse direct agencies, such as variations in microclimate, and to indirect agencies, such as the relation to the pest of the other fauna.

[STATELOV (N.).] **Стателов (Н.). Beobachtungen und Untersuchungen über die Biologie, Oekologie und Bekämpfung des Luzernkäfers, *Phytodecta fornicata* Brüggm.** [Observations and Investigations on the Biology, Ecology and Control of the Lucerne Beetle, *P. fornicata*.] [*In Bulgarian.*]—*Minist. Landw. Staatsdom.* [Publ.] no. 63, 44 pp., 7 figs., 16 refs. Sofia, 1936. (With a Summary in German.)

A detailed account is given of studies in 1930–32 and 1935–36 on the bionomics of the Chrysomelid, *Phytodecta fornicata*, Brüggm., in Bulgaria, where it is an important pest of lucerne. All stages are described. There is one generation a year, and both adults and larvae feed on the leaves, the latter sometimes destroying entire crops. The adults overwinter in the soil; they occurred at a depth of 3–11 ins. and emerged in the course of 15–20 days, beginning when the soil temperature rose to 10–12°C. [50–53·6°F.]. After maturation feeding for 2–5 days, the beetles paired and laid eggs in batches of 2–22 on the lower surface of the leaves. The oviposition period lasted 38–41 days. In the laboratory, females laid about 1[illegible] eggs at intervals ranging from 1 to 12 days, 76 per cent. on the first day. The average adult longevity was 15–16 days for males and 41 for females. The egg stage lasted about 9 days at 14°C. [57·2°F.] and about 5 days at 23°C. [73·4°F.], but the period varied by 1–2 days for eggs of the same batch. The larvae developed in 15–23 days, requiring 16 days at 20°C. [68°F.], and then pupated in the soil at a depth of 2 ins. or less. The pupal stage was completed within 3 weeks, but most of the adults remained in the soil and penetrated deeper to hibernate. Some, however, came to the surface, usually in the middle of June, fed on the lucerne for 2–3 weeks, and then re-entered the soil for hibernation.

Experiments on control showed that mowing the lucerne early in May to destroy the eggs and young larvae is of great value; in view, however, of the protracted oviposition period, the mowing should be repeated once or twice at intervals of 15–20 days. In two experiments, flooding the fields for 10 days killed all the larvae and pupae, as well as 70·7 per cent. of the adults in one instance and 32·5 per cent. in the other. The best time for flooding is late May or early June, since the pupae are the least resistant stage. A spray of 2–2½ lb. Paris green and 8–10 lb. lime in 100 gals. water may be applied after the hay has been removed from the field, but domestic animals must be kept away for at least 3 weeks afterwards.

Laidlaw (W. B. R.). **The Brown Lacewing Flies (Hemerobiidae) : their Importance as Controls of** *Adelges cooleyi* **Gillette.**—*Ent. mon. Mag.* **72** nos. 866–867 pp. 164–174, 1 pl., 3 graphs. London, July–August 1936.

An account is given of the bionomics of *Boriomyia subnebulosa*, Steph., and *Hemerobius stigma*, Steph., the larvae of which feed on *Chermes* (*Adelges*) and other Aphids in Scotland. All stages of *H. stigma* and the adult of *B. subnebulosa* are described. The latter occurs on Douglas fir [*Pseudotsuga taxifolia*] and other conifers in Aberdeenshire. The adults emerge from April onwards and lay eggs. The males soon disappear, and the larvae pass through three instars, and then pupate under dry bark, etc. The first-generation adults appear in August and September, and the progeny of these hibernate as prepupae, and pupate in the following March.

H. stigma has been found on Douglas fir, larch, Scots pine [*Pinus sylvestris*] and spruce, in association with *C.* (*A.*) *cooleyi*, Gill., *C.* (*A.*) *viridis*, Ratz., *Cinara* (*Lachnus*) *pini*, L., and *Rhopalosiphum* (*Neomyzaphis*) *abietina*, Wlk., respectively. Adults appear in early April and eggs were first laid on the needles of Douglas fir on 10th April in the laboratory, and were taken in the field on 19th April. About 1–11 eggs were laid daily, and these hatched in about 11 days, or slightly less as the season progressed. One female laid 80 eggs. Mortality was high among the young larvae, as newly hatched *Chermes*, their normal food, were not abundant until late May, and they were unable to pierce the cuticle of mature *Chermes* or eggs in order to feed. The larvae, which avoid the light, pass through three instars, and mature in 30 days. The prepupal and pupal stages last 8 and 10 days respectively. Two generations generally occur during the year, the second of which hibernates in the prepupal state. Adults, which feed during the daytime, readily attack all stages of *Chermes*, but slightly prefer the eggs.

Several other species of *Hemerobius* occur on conifers, but in the control of *Chermes* Hemerobiids are second in importance to the Coccinellid, *Aphidecta obliterata*, L. The author considers, however, that they might be very efficient if fostered artificially, and gives figures to show the potential number of *C. cooleyi* that would be destroyed in a year by a single pair of *H. stigma* and their descendants.

Wakely (S.). **Occurrence of an Australian Beetle,** *Anthrenocerus australis* **Hope, together with** *Attagenus piceus* **Ol. var.** *megatoma* **F. at Finsbury.**—*Ent. mon. Mag.* **72** no. 867 pp. 174–175. London, August 1936.

Large numbers of Dermestid beetles have been observed for some years in a printing works in London. The larvae were first found in the winter of 1935–36, and identification of adults reared from them [see next paper] showed that they comprised two species, *Attagenus piceus* var. *megatoma*, F., and *Anthrenocerus australis*, Hope. The latter appeared to be the more abundant, possibly because the larvae are more active. The larvae of both species were found in cracks in the floor, under old boxes, etc., in one instance feeding on some dried milk that had fallen behind a box; they were readily attracted to cake crumbs. The adults begin to appear in May and continue throughout the summer.

Blair (K. G.). **An Australian Dermestid Beetle,** *Anthrenocerus australis* **Hope, in London.**—*Ent. mon. Mag.* **72** no. 867 pp. 175–177. London, August 1936.

The author reared the Dermestid larvae referred to in the preceding paper and identified the resulting adults as *Attagenus piceus* var. *megatoma*, F., and *Anthrenocerus australis*, Hope, an Australian species. He gives brief descriptions of the larvae of both and the adults of *Anthrenocerus*. The latter began to appear in early June, and continued to emerge for some weeks.

Brooks (C. C.) & Brown (J. M. B.). **Studies on the Pine Shoot Moth (*Evetria buoliana* Schiff.).**—*Bull. For. Comm.* no. 16, 46 pp., 7 pls., 52 refs. London, H.M.S.O., 1936. Price 1*s*.

This report on investigations begun in 1928 on the infestation of pines by *Rhyacionia* (*Evetria*) *buoliana*, Schiff., in East Anglia is in two parts. The first (pp. 5–26) deals with the biology and forest relations of the moth and was prepared by R. N. Chrystal from an unfinished manuscript by Brooks, who lost his life in June 1930. The literature on the moth is briefly reviewed and the adult is described. It was probably introduced into England in late historical times ; the northern parts of Britain have not yet been colonised. The moths fly in the evening and are usually quiescent during the day. The females, which live up to three weeks or rather longer than the males, lay an average of 76 eggs singly or in groups of two or three on the green bark of young shoots, particularly on the upper parts of the trees or on trees that are dominant. The eggs usually hatch in about a fortnight. The larva ascends to the bud whorl, where it tends to withdraw into cracks, spins a web to prevent the resin from coming into contact with its body, bites through the bud scales and begins to feed at once on the soft tissues within. All the food-burrows are lined with silk. When one bud is exhausted, the larva migrates to another, or even to another branch, but this does not usually happen till the spring. As a rule it hibernates in the third instar, occupying a spiral cavity about the central axis of the stem. In a large whorl a lateral bud is selected, perhaps because very young larvae cannot cope with the large supply of resin in the central buds. In the spring the larvae show great activity, destroying whole whorls and migrating from branch to branch. There is no evidence to show that they sometimes inhabit old tunnels of the pine shoot beetle, *Myelophilus piniperda*, L. [*cf. R.A.E.*, A **17** 14] ; in fact they appear to migrate from shoots killed by it. In late June or early July, the larva pupates in a dead bud or crevice. The pupal period varies from 12 days to 5 weeks according to temperature, but averages about 16 days.

The damage is of importance when the leading shoot of the tree is injured. This results in various types of deformation, which are discussed in some detail. The percentage of infested leaders is highest where plantations abut on the pine shelter belts that are abundant in East Anglia, and it generally reaches a peak in the sixth year. As the tree grows older, there is a rapid decrease in the relative numerical proportion of leading shoots to lateral shoots and the chances of attack on the leading shoots are diminished. The removal of the side buds in infested whorls on leading shoots is suggested as a method of control. Of the numerous parasites [**19** 29], the most

important are the Braconid, *Orgilus obscurator*, Nees, and three Ichneumonids, *Cremastus interruptor*, Grav., *Omorgus mutabilis*, Hlmgr., and *Eulimneria rufifemur*, Thoms. [*cf.* **20** 368]. The last is considered to be very efficient, its period of oviposition coincides with that of the greatest vulnerability of the host and it is very active, being well represented even where the latter is scarce. If, however, it occurs with *Cremastus*, it is almost invariably suppressed by the latter, which is much less active and is only numerous when the host population is dense.

The second part of the report is by Brown and deals with the status of the pest in East Anglia, based on a survey of about 13,000 acres of plantations, chiefly of Scots pine [*Pinus sylvestris*] but including considerable areas of Corsican pine [*P. nigra* var. *calabrica*], and with experiments in control. Outbreaks of *R. buoliana* develop rapidly in young plantations, but after ten years a rapid decline sets in that is probably due to parasites. In the early years of attack, the polyphagous parasites are hampered by the lack of alternative hosts in areas of pure Scots pine. The critical factor is the growth of the trees in the few years after the climax of the outbreak. Where growth is rapid, recovery is good, fresh leaders are soon gained by most of the damaged trees and the commoner milder deformations are almost obliterated. In plantations where poor growth has aggravated attack, it has impeded recovery. Unhealthy trees have small buds, so that more are damaged by a given number of larvae. Healthy trees form a thicket and, competing for light, aid one another to regain straight leaders. The older plantations in a number of localities were examined, and trees classified according to damage. The mean percentage of dominant trees quite undamaged by the moth was 8·3, and that of trees with apparently serious and permanent deformation 32·1. Trees with " post-horn " damage were included amongst the latter, but may still produce a saleable length of straight timber above the injury.

Following Brooks' recommendations, the side buds were removed from all infested leading bud whorls in more than 2,000 trees in an attempt to deflect attack from the leading shoot. Owing to the spring migrations of the larvae, however, only about half the disbudded infested leaders escaped distortion, while nearly 40 per cent. of the leaders in the control were uninjured. Further experiments showed that disbudding provided no protection against severe attack. If the leader dies after disbudding, the new leader is forced to come from a lateral branch of the whorl below, while there is a better chance of obtaining a straight stem in the controls, where the entire upper whorl is less likely to be destroyed. In plantations more than twelve years old, badly deformed large trees tend to suppress smaller straight ones. Where possible they should be removed, together with thinnings of a size that permits the breeding of *M. piniperda*, to prevent outbreaks of this beetle. Another suggested method of control is the pruning of all infested shoots in young plants, as it is important to delay the initial rise of the outbreak, and Scots pine should only be planted where it will thrive in its earliest years.

In two adjacent plantations of Scots and Corsican pine of the same age, the percentage of normal undamaged trees fell in Scots pine from 60 in 1932 to 32 in 1933, and in Corsican pine from 64 to 53. Other records showed that, in 600 plants of Corsican pine in September 1932, 30 per cent. of the bud whorls were infested by the larvae, but a year later only 8 per cent. of the trees had lost their leaders. Probably the

larger buds in this species make migration to the central one less likely. Also they are highly resinous, and this may lead to the death of some of the larvae. Within limits Corsican pine should be planted in preference to Scots pine, as it grows rapidly and is relatively immune from injury by rabbits and the pine aphis, *Cinara* (*Lachnus*) *pini*, L. In mixed plantations it would suppress the Scots pine, but it can be used for shelter belts and for protection between old infested areas and young plantations.

Soulié (H.). **La lutte contre le ver des pommes dans le Puy-de-Dôme.** —*Ann. Épiphyt. Phytogén.* N.S. **2** no. 2 pp. 159–189, 7 figs., 57 refs. Paris, 1936.

Work in the United States and France on the control of *Cydia pomonella*, L., on apple and on its biology in relation to temperature and humidity is reviewed in detail, and the organisation of its control in the Department of Puy-de-Dôme is discussed. The probable abundance of the moths of the overwintered generation may be estimated by the heaviness of infestation in the previous year, and by the numbers of larvae hibernating under trap bands in the early spring, and should be checked, together with the period of flight, by means of traps and breeding cages. These last, with thermometers and rain gauges, were used in five orchards in the main fruit-growing regions of Puy-de-Dôme in 1935, and this service is being increased. The temperature at the time of flight determines the number of larvae in the first generation, as oviposition does not occur below 16°C. [60·8°F.]. The critical periods are usually from early June to about mid-July, and the second week in August when the new generation, if any, will appear.

Tests were made of the value of a calyx and three cover sprays of lead arsenate, applied on 15th May, 14th June, 10th July and 13th August. One or more of these sprays were omitted on certain trees. The main flight of moths occurred very early in June. The results indicated that the calyx spray was of little importance, and that the first and second cover sprays were those of greatest value, as by themselves they reduced the number of infested fruit by 90 per cent. A spray of nicotine sulphate and white oil proved much less efficient than lead arsenate, but the latter must not be applied in France within two months of harvest.

Chappellier (A.) & Raucourt (M.). **Les traitements insecticides arsenicaux sont-ils dangereux pour le gibier et pour les animaux de la ferme ?**—*Ann. Épiphyt. Phytogén.* N.S. **2** no. 2 pp. 191–239, 1 fig., 23 refs. Paris, 1936.

Experiments were carried out to determine the minimum lethal doses for hares, rabbits and partridges of 4 insoluble arsenicals commonly used in France against *Leptinotarsa decemlineata*, Say [*cf. R.A.E.*, A **22** 460]. The first tests were made on domestic rabbits, which had fasted for 24 hours, and were checked on hares and wild rabbits. The lethal doses per kg. body-weight were : diplumbic lead arsenate, 200 mg. (40·4 mg. As.) ; calcium arsenate, 85 mg. (23·5 mg. As.) ; aluminium arsenate, 70 mg. (22 mg. As.) ; Paris Green, 30 mg. (12·4 mg. As.). These also obtained for rabbits fed normally up to the time of the experiments. A certain resistance to repeated sub-lethal doses was acquired only with Paris green. Experiments showed that the elimination of arsenic by means of urine and faeces is rather slow in the rabbit.

With partridges the preliminary fasting period was reduced to 16 hours. Diplumbic lead arsenate (lethal dose 300 mg.) was rather less toxic than for rabbits, calcium arsenate (50 mg.) and Paris green (25 mg.) rather more so. Repeated sub-lethal doses of calcium arsenate produced a certain amount of resistance. This bird is much more sensitive to arsenicals than others. The lethal dose of diplumbic lead arsenate for a domestic fowl was about 6 gm. per kg. body-weight. Partridges are generally thought to have been killed by eating poisoned adults and larvae of *L. decemlineata*, but experiments showed that 350 larvae would have to be consumed before this could happen [*cf.* **22** 687].

Rabbits ate plants treated with arsenicals with extreme reluctance and appeared to be quite unaffected by them. Analytical tests carried out on hares, rabbits and partridges after the experiments showed that arsenic was not present in sufficient quantities to involve a risk in using them for food.

An extensive system of inquiries produced practically no evidence of the destruction of game by insecticides; in most cases the bodies of animals supposed to have been poisoned were not analysed for arsenic. In nearly all the cases of poisoning of farm animals there appears to have been negligence in carrying out or supervising the applications of insecticide. A detailed report of the inquiry and the replies received is given. The authors conclude that danger to game could only occur in very exceptional circumstances, and that, if ordinary precautions are taken, there is no risk to man or to farm animals.

Chappellier (A.) & Raucourt (M.). **Les oiseaux contre le doryphore.**—*Ann. Épiphyt. Phytogén.* N.S. **2** no. 2 pp. 241–252, 3 refs. Paris, 1936.

Experiments in France on the use of partridges and poultry against *Leptinotarsa decemlineata*, Say, showed that some young hand-reared partridges ate a considerable number of the larvae supplied to them. It is, however, most unlikely that, under natural conditions, they would eat them in sufficient quantities to be of economic importance. Domestic fowls eat them to some extent, but pigeons, guinea-fowls, geese, turkeys and ducks are almost indifferent to their presence. Details of information produced by an inquiry are appended, and the author concludes that insecticides are the only practicable means of control.

Fagniez (C.). **Un charançon nuisible aux plantations de pêchers.**—*Rev. franç. Ent.* **3** fasc. 2 pp. 108–109. Paris, July 1936.

In April 1930, 3,000 young peach trees planted a few months previously on the site of a partly burnt out forest of pine and cork oak [*Quercus ilex* var. *suber*] in the extreme south of France were severely attacked by adults of *Polydrusus marginatus*, Steph. The weevils, of which there were sometimes a hundred on one tree, were devouring leaves, buds and even bark to such an extent that the flow of sap was being stopped. They could not have flown from an adjoining forest of cork oak, as examination showed that, although possessing dehiscent elytra, they had only rudimentary wings. The infestation had therefore apparently arisen from larvae that were in the soil when the remaining cork oaks were cut down preparatory to planting the orchard. The adults emerging in the following season had climbed the peach trees in

the absence of their usual food-plants and attacked them as described. Eradication was effected by shaking the weevils from the trees and preventing them from returning by means of adhesive bands. Although all those examined were apterous, it is possible that *P. marginatus*, like some other weevils, may be either macropterous or brachypterous. The three other species of the subgenus *Metallites* found in France are all alate.

MALENOTTI (E.). **Sui Consorzi di difesa della frutticoltura.** [Orchard Protection Associations.]—*G. Agric. Domen.* 1936 no. 25, reprint 7 pp., 6 figs. Rome, 21st June 1936.

A fruit-growers' association at Treviso organised collective control against the apple blossom weevil [*Anthonomus pomorum*, L.] by jarring the adults off the trees on to sheets beneath. This measure caused the fall of thousands of larvae of *Coleophora hemerobiella*, Scop., which mine the leaves of apple and also the flower buds, the injury to the latter sometimes reducing the crop considerably.

MALENOTTI (E.). **Quarto anno di osservazioni e di prove sui nemici del melo.** [The fourth Year of Observations and Experiments on Apple Pests.]—*Italia agric.* **73** no. 8 pp. 591–607, 10 figs., 6 graphs. Rome, August 1936.

Observations on apple pests in Venetia [*cf. R.A.E.*, A **23** 302, etc.] were continued in 1935. The difference in date between the fall of the apple petals and the emergence of the adults of *Cydia pomonella*, L. [**21** 372] was confirmed. Adults were not taken in traps baited with molasses until long after they had emerged in large breeding cages, so that it would be unsafe to rely on bait-traps to indicate the date for starting control. Eggs of the first generation required at least 10 days to hatch in May at 21°C. [69·8°F.] and those of the second only about half as long in July at 30°C. [86°F.]. Eggs laid on a given day by a given female hatched gradually, the incubation period varying by almost 100 per cent. In the province of Verona there were 3 generations, the third being incomplete. The percentages of apples infested were 42 on untreated trees and 2·3 on trees sprayed five times with 0·5 per cent. lead arsenate. Three applications against the first generation gave results somewhat inferior to one application against the first and one against the second, and five applications at 0·3 per cent. strength gave better results than four at 0·5 per cent. The Tingid, *Stephanitis pyri*, F., was observed on apple early in May, but soon disappeared.

KAWECKI (Z.). **Misecznik dwuguzek** (*Lecanium bituberculatum* **Targ.**). —*Ogrodnictwo* **30** fasc. 2 separate 7 pp., 3 figs., 7 refs. Krakow, 1935. (With a Summary in German.) [Recd. 1936.]

In the environs of Krakow considerable damage to apples, pears, plums and hawthorn (*Crataegus*) is caused by *Lecanium bituberculatum*, Targ., all stages of which are briefly described. Hibernation takes place in the egg stage under the scale of the dead female, and the nymphs, which are very active, hatch in the beginning of May and crawl to the leaves. The adult males have been observed as early as 16th June and pairing occurs before the females are full-grown. The

latter then crawl from the leaves and attach themselves to shoots and twigs up to 5 years old. Oviposition occurs in September, and after depositing up to 700 eggs, the female dies.

Predtechenskiĭ (S. A.), Zhdanov (S. P.) & Popova (A. A.). **Injurious Locusts in U.S.S.R. (Review of the Years 1925–1933).**—*Bull. Plant Prot.* (1, Ent.) no. 18, 167 pp., 17 figs., 4 pp. refs. Leningrad & Moscow, 1935. (With a Summary in English.) [Recd. 1936.]

The breeding centres of *Dociostaurus maroccanus*, Thnb., and the two races of *Locusta migratoria*, L., *viz.*, race *rossica*, Uv. & Zol. (for which the author uses the name *danica*, L. [*cf. R.A.E.*, A **18** 55]) and *migratoria*, throughout the Russian Union are enumerated and shown on maps, and the breeding and migrations of *Locusta* during 1925–33, as well as the factors regulating the periodicity of outbreaks, are discussed. In the outbreak centres of the northern race (*rossica*) [*cf.* **17** 139 ; **19** 333], the climatic conditions were generally unfavourable, though a small outbreak occurred in 1933 owing to the exceptionally warm summer of 1932. Among the outbreak centres of the southern race (*migratoria*), which are mostly situated in the reed beds at the mouths of the rivers in the semi-desert steppe zone, where the locust populations are regulated mainly by the level of the spring floods [*cf.* **19** 334], those in Daghestan, near Lake Balkash and in the reed-beds of the Syr-Daria river are the most important. The most serious outbreak occurred in 1927, and an average area of over 400,000 acres was annually infested by egg-deposits. Chemical methods of control, in particular dusting from aeroplanes, were extensively used towards the end of the period surveyed.

Dociostaurus maroccanus occurs in Central Asia, the Caucasus, Crimea and south-western Ukraine, and the permanent reservations are found in dry steppe habitats overgrown by *Poa bulbosa*, which can be used as an index plant in egg-deposit surveys [*cf.* **22** 242]. In Central Asia this locust increased in numbers from 1928 to 1933, while in other outbreak areas it was most abundant in 1931 and 1932. The 1932–33 outbreak in Central Asia was partly due to an incursion of swarms from Afghanistan ; similarly Azerbaijan is sometimes invaded from Persia. In both these cases, the outbreak areas stretch across the international boundary, and swarms migrate across it in either direction. In the northern Caucasus conditions favouring outbreaks occur in the dry years, for in wet years all stages are liable to fungous epidemics. Fungi destroyed 50 per cent. of egg-pods in Azerbaijan in 1935 and most of egg-pods in Central Asia in 1934. In the latter region, however, very dry years are just as unfavourable, owing to the desiccation of the eggs and the absence of green food.

The recent invasions of Trancaucasia and Central Asia by *Schistocerca gregaria*, Forsk., are described [*cf.* **23** 581], and notes are given on the life-history, habitats and distribution in the Russian Union of *Calliptamus italicus*, L. [*cf.* **24** 592], *C. turanicus*, Tarb., *Aeropus sibiricus*, L., *Pararcyptera microptera*, F. W., *Dociostaurus* spp., *Stauroderus scalaris*, F. W., *Chorthippus* spp., *Ramburiella turcomana*, F. W., *Oedaleus decorus*, Germ., *Oedipoda coerulescens*, L., *Arcyptera fusca*, Pall., *Podisma pedestris*, L., *Prumna primnoa*, F. W., *Dericorys* spp., and *Conophyma* spp. Particulars are also given of the activity of these and a few other Acridids during 1925–33 in different parts of the Union ;

and Russia in Europe is divided into 13 and Russia in Asia into 9 zones or natural regions, each characterised by a definite fauna of injurious Acridids.

[Savchenko (E. N.) & Ratner (Yu. B.).] **Савченко (Е. Н.) и Ратнер (Ю. Б.). The Application of different Preparations of Anabasine and Lupinine for the Control of Beet Aphids.** [*In Russian.*]—*Nauch. Zap. sakharn. Prom.* **12** (1935) no. 5–6 pp. 141–157, 1 graph, 51 refs. Kiev, 1936.

A detailed account is given of laboratory experiments in Russia to compare the effectiveness against Aphids of anabasine, its sulphate, naphthenate and resinate, and of lupinine, which is obtainable in considerable quantities from *Anabasis aphylla* [*cf. R.A.E.*, A **24** 351]. The Aphids used were *Aphis fabae*, Scop., and *Myzus* (*Myzodes*) *persicae*, Sulz., and the rates of mortality produced by spraying with the various preparations are shown in tables; the percentages given are averages for both species. In the first series of tests the anabasine and the salts were dissolved in water (with or without the addition of naphthene soap) at a concentration equivalent to 0·02 per cent. of the alkaloid. Lupinine was also tested at a higher concentration. When used without the soap, the most effective was anabasine naphthenate, which killed 79 per cent. of the Aphids. If its efficiency is rated as 100, the relative efficiencies of the other sprays were anabasine sulphate 91, anabasine resinate 77, anabasine 58 and lupinine 3. When naphthene soap was used in the sprays, the highest kill (89 per cent.) was obtained with anabasine sulphate and the relative efficiencies were anabasine sulphate 100, anabasine naphthenate 98, anabasine 96, anabasine resinate 85 and lupinine 3. The relative decrease in the effectiveness of anabasine naphthenate when combined with naphthene soap was probably due to a decrease of the hydrolysis of the soap as the result of the presence in the spray of ions of naphthene acid from two sources (the soap and the anabasine naphthenate), so that the concentration of the free naphthene acid, which possesses an independent insecticidal action, was reduced. From these tests, it is concluded that anabasine resinate and lupinine are unsuitable for use as insecticides.

Further tests on *M. persicae*, in which various concentrations of anabasine and the sulphate were used with 0·4 per cent. of naphthene soap and anabasine naphthenate was used alone, showed that the latter spray would be the cheapest, since even at a concentration of 0·03 per cent. it killed 96 per cent. of the Aphids. The addition of mineral oil emulsions or of small quantities of " Contact " [**20** 199] or pectin glue considerably increased the effectiveness of anabasine [*cf.* **24** 351].

With a view to determining the factors on which the effectiveness of these preparations depends, the physico-chemical properties of the solutions were studied and are discussed in detail. It was found that the hydrogen-ion concentration exercises a considerable influence on the effectiveness of the spray, chiefly in the case of different solutions of the same preparation. With the addition of naphthene soap all the preparations acquired an alkaline reaction, whereas the addition of large quantities of " Contact " or pectin glue considerably increased the concentration of the hydrogen ions, which reduced the effectiveness of the spray. With a decrease of the surface tension and viscosity the effectiveness of the spray usually increased. There is a certain antagonism of action between surface tension on one side and viscosity and

pH on the other. A high concentration of hydrogen ions and high viscosity usually neutralise the effect of low surface tension. It appears that the bicyclic alkaloids are more toxic than the monocyclic ones. The insecticidal properties of alkaloids that are similar in structure depends on the elasticity and volatility of their vapours, but their toxicity is equally decreased when volatility is too high or too low. The comparative effectiveness of the water solutions of nicotine or anabasine and their salts also depends on the volatility of the vapours, since when applied as sprays they act as fumigants. The volatile anabasine and nicotine rapidly form high concentrations but do not maintain them for long, whereas the corresponding salts evaporate slowly and keep up a definite concentration of vapours during a prolonged period, which explains their relatively greater effectiveness.

The authors suggest the use of the term "effectiveness" instead of "toxicity" to express the insecticidal value of alkaloids in sprays. Under these conditions the alkaloids and their salts possess equal potential toxicity, as the active principle of both is the alkaloid that penetrates into the body of the insect in a vaporous or gaseous state through the tracheal system. The insecticidal action, therefore, does not depend on the different toxicity of the preparations, but on the effect of the physical properties of the solutions on the rate of evaporation and penetration of the alkaloid into the tracheae.

[Borkhsenius (N. S.).] **Борхсениус (Н. С.). Zu der Fauna Schildläuse (Coccidae) des Kaukasus.** [Contribution to the Coccid Fauna of the Caucasus.] [*In Russian.*]—*Trud. krasnodarsk. s.-kh. Inst.* no. 4 pp. 97–139, 3 figs., 2 refs. Krasnodar, 1936. (With a Summary in German.)

Records are given of 112 species of Coccids occurring in the Caucasus, chiefly the Black Sea coastal zone and Transcaucasia, with notes on the bionomics of some of them. Two species, *Phenacoccus gavalovi* and *P. ussuriensis*, are new, and the females are described in Russian and English; the males are not known. *P. gavalovi* was taken on the roots of dewberry (*Rubus caesius*), and *P. ussuriensis* was intercepted in quarantine on fruit trees from the Russian Far East, where it is a serious pest, occurring on species of *Prunus*, *Pyrus*, *Craetaegus* and *Syringa*. The species of which the biology is discussed include *Pulvinaria aurantii*, Ckll., *Coccus pseudomagnoliarum*, Kuw., *Parlatoria zizyphus*, Lucas, *Lepidosaphes beckii*, Newm., *L. gloveri*, Pack., *Chrysomphalus dictyospermi*, Morg., *Aonidiella citrina*, Coq., and *Pseudococcus gahani*, Green, all of which attack *Citrus*, *Antonina bambusae*, Mask., which is a serious pest of bamboo, and *Aspidiotus destructor*, Sign., which occurs on tea and *Laurus nobilis*.

Trionymus diminutus, Leon., is a serious pest of New Zealand flax (*Phormium tenax*) in the environs of Batum. It has 3 overlapping generations a year, the larvae and adult females hibernating. Oviposition begins in May, the eggs being laid on dry leaves of the foodplant and sometimes inside the sheaths of the green leaves. The number of eggs laid by a female averages 655 in May, 241 in August and 157 in September. Oviposition is completed in 8–12 days, after which the females die. The nymphs hatch in 6–10 days and, after resting for 1–2 days in the ovisac, disperse over the green leaves and shelter in the

sheaths, where the females spend their whole life. Both sexes become adult about 40 days after they hatch, but the females have a preoviposition period of 25–30 days.

The mealybugs occur in large colonies in the sheaths of the leaves, but as they chiefly infest the outer leaves, the plants are not killed. Their numbers are greatly reduced by prolonged rain, which washes them away or destroys the waxy secretion that protects them. Plantations on damp soil are less infested than those on dry ground. Predators include Coccinellids and *Chrysopa* sp., but they are of no importance, as the mealybugs in the sheaths of the leaves are inaccessible.

MIHRA (R. D.). **Spotted Boll-worms in South Gujarat.**—24 pp., 8 figs., 1 map. Bombay, Indian cent. Cott. Comm., 1935. [Recd. 1936.]

This is a summary of the more important results of investigations, made from 1923 to 1934 by a group of workers appointed by the Bombay Department of Agriculture, on *Earias fabia*, Stoll., and *E. insulana*, Boisd., attacking cotton in the Bombay Presidency. The eggs are laid only at night, on tender shoots, branches, stalks of flower buds and bolls, and hatch in 4–7 days. The larvae enter shoots, flower buds or bolls and feed in them for 9–16 days, moving from one to another. The pupal period is passed 2–10 ins. below the surface of the soil and lasts 8–14 days. The adults live 8–22 days and oviposit principally during the first week, laying an average of 432 eggs. About 12 life-cycles are completed in a year.

The damage to cotton is worst when the plants are about a foot high, when 40–50 per cent. of the growing shoots of the main stem are sometimes withered by the boring of the larvae into the stem. As soon as the buds develop, they too are attacked. Investigations during 3 seasons showed that 34–51 per cent. of the fallen buds and 20–69 per cent. of the fallen bolls had been damaged by the larvae. The larvae are most numerous in November and December, when they are attacking the flower-buds and bolls on the cessation of the monsoon. The population declines in January owing to cold and the activity of parasites. During this period a late crop develops in place of the mutilated bolls. To determine the probable increase in the yield if infestation were eradicated, mosquito curtains were placed over plants before sunset on vertical iron supports and removed in the morning. Moths resting on the plants were previously dislodged. In addition, a small circular tin gutter was sunk in the soil round the base of each plant when it was 6–10 ins. high, and kept filled with water on which was a film of oil. More than 100 plants were grown under these conditions, and gave substantially higher yields than unprotected plants; in the first year the increase was 81 per cent. and in the second 54 per cent. The crop was ready to be gathered 4–6 weeks earlier than that on infested plants.

Various control measures were tried, of which the majority were found unsuccesful. These were the picking off of damaged shoots; planting of bhindi [*Hibiscus esculentus*], which failed to protect the cotton and on which the insects bred in large numbers; acceleration of the activities of the parasite, *Microbracon lefroyi*, D. & G., by breeding and releasing it; exposing baits, a list of which is given; the use of a soil mulch; and applications of sprays and dusts of lead arsenate or Paris green. Dusts of calcium arsenate or sodium fluosilicate reduced

the numbers of larvae, but serious infestation by Aphids occurred on plants whitened by them. When powdered charcoal was mixed with the dusts, the Aphid infestation decreased but did not disappear. The most successful control measure was cultural. Between April, when the crop is harvested, and the third week in June, when the next one is sown, the ground should be kept perfectly clean so that no food-plants are available. Cotton plants should be uprooted, malvaceous weeds destroyed and the cultivation of *H. esculentus* stopped. This was done with increasing efficiency in a selected area from 1931 to 1934. At the beginning of the work, infestation was more severe than in the surrounding districts; at the end it was much less severe and did not become evident until later in the season, while the crop was ready for harvest earlier. An illustration is given of an implement, working with a lever, by means of which the plants can readily be pulled out of the soil.

Husain (M. A.), Khan (M. Haroon) & Ahmad (N.). **Ecological Studies of Pink Bollworm** (*Platyedra gossypiella*, **Saunders**).—*Curr. Sci.* **3** no. 7 pp. 304–305. Bangalore, January 1935. [Recd. 1936.]

Observations carried out in India in 1931–33 showed that temperature acting on the pupae and adults largely determines the number of eggs laid by *Platyedra gossypiella*, Saund. The optimum temperature for the full development of the gonads and the maximum number of eggs was 75–82°F. The average numbers of eggs per female were 98 when the pupae and adults were kept at 75°F., and only 23 when they were kept at 95°F. At 92°F. over 80 per cent. of the females did not produce eggs, and the males were incapable of fertilising females. The influence of humidity was not so thoroughly worked out, but a high relative humidity appeared to be most favourable for the development of the gonads and the deposition of eggs.

On the basis of these results, a correlation between the biotic potential and the environmental resistance under natural conditions was established. A study of the three years' meteorological data showed that oviposition was highest when the mean maximum temperature acting on the pupae and adults was about 90°F., the mean minimum 72°F. and the relative humidity 70 per cent. To forecast the intensity of infestation in any particular district, the meteorological conditions during the cotton-growing season and the time of emergence of the moths produced by the "long-cycle" larvae must be ascertained. Infestation will not occur unless the emergence of the moths coincides with the fruiting of the cotton, and will only be serious if the climatic conditions are favourable.

Husain (M. A.), Puri (A. N.) & Trehan (K. N.). **Cell Sap Acidity and the Incidence of White-fly** (*Bemisia gossypiperda*) **on Cottons.**—*Curr. Sci.* **4** no. 7 pp. 486–487, 3 refs. Bangalore, January 1936.

Bemisia gossypiperda, Misra & Lamba, lays most of its eggs on tender leaves, on which later the nymphs feed, and, in India, infests indigenous varieties of cotton more seriously early in the season, and American types in July or August. This behaviour is probably mainly dependent on some difference in the cell sap of the tender and older leaves and to changes in the sap of the varieties during different parts of the year.

Since the one easily measurable change in the sap is its pH value, investigations were undertaken in 1932–33 to test this in indigenous (Mollisoni) and exotic (289 F.) types grown under identical conditions. Preliminary results showed that the pH gradient from top to bottom varied with the age of the plants. During 1932, the average pH values for the exotic variety were lower than those for the indigenous variety except in July and part of August, when the values for the two varieties were equal. The relative incidence of infestation corresponded with the trend of the pH curve, indicating partiality towards higher pH values. There was a certain amount of lag in the fluctuations of infestation, because the nymphs do not move, and probably also because some time is required before the effect of the change in the pH values is felt by the insects feeding on the sap. During 1933 the whitefly attack in general was insignificant, and the pH values were also relatively low.

Mukerji (D. D.) & Bhuya (M. A. H.). **Life History of** *Chaetostricha mukerji* **Mani (Trichogrammidae : Hymenoptera).**—*Zool. Anz.* **115** no. 7–8 pp. 209–212, 4 figs., 7 refs. Leipzig, 15th August 1936.

An account is given of a laboratory study in Calcutta of the life-history of the Trichogrammatid, *Chaetostricha mukerjii*, Mani, a parasite of the eggs of *Bruchus quadrimaculatus*, F. After pairing, the females introduced their eggs into those of the Bruchid, generally only one in each egg. They usually died on the third day of oviposition. The yolk of the host disappeared with the growth of the parasite larva, which pupated within the host egg, the adult emerging by cutting a hole in the convex surface of the shell. The life-cycle took about 7 days in August. A table shows the dates of exposure of the host eggs, the number of eggs exposed to each female, the number of eggs laid by it on the first, second and third day, the actual number of parasites that emerged, and the number of days taken to complete the life-cycle. The number of parasites that emerged ranged from 5 (when 24 host eggs were exposed) to 19 (when 26 were exposed).

Summary of the Work of the Entomological Division during 1935.—*Trop. Agriculturist* **86** no. 6 pp. 343–348. Peradeniya, June 1936.

During 1935, *Stephanoderes hampei*, Ferr., on coffee and an Anthomyiid, *Atherigona* sp., on rice were recorded for the first time in Ceylon. *S. hampei* was declared a pest, and in a systematic campaign, during which it was found to be widely distributed in the south of the Island, over 30,000 coffee plants were pruned and the berries destroyed. In districts including central, eastern and north-eastern Ceylon, *Atherigona* attacked seedling rice within a week of germination. The larvae cut through the young central shoot, feed on the decaying portion and pupate inside the stem, usually near the base. The life-cycle occupied about 2 weeks. In many areas where there was a shortage of water at least 50 per cent. of the plants were killed, but where more water was available they tillered vigorously and outgrew the infestation. In one district about 16 acres of rice were severely infested by *Spodoptera mauritia*, Boisd., during October. Satisfactory control was obtained by flooding the fields, spraying a mixture of equal parts of kerosene and crude oil on the water to form a continuous film, and then brushing the larvae into the water with bundles of twigs.

A severe infestation of coconuts by *Nephantis serinopa*, Meyr., which began in 1934 [*cf. R.A.E.*, A **24** 101], continued into 1935, but decreased rapidly after heavy rains; in one district it was partly controlled by local parasites. *Trichospilus pupivora*, Ferrière, a pupal parasite of *N. serinopa* already established in the west and north-west of Ceylon, was imported from India for breeding purposes, since it was not available locally during the year. It was bred largely on the pupae of *Spodoptera mauritia*, as normal host material was scarce, and over 150,000 adults had been liberated up to the end of April 1936. Another satisfactory host for breeding was *Sylepta derogata*, F. Tests with preparations for impregnating timber against termites were continued. A sample of timber treated with a solution of rubber distillate has resisted attack during the 2½ years of the test. Pests recorded on food-plants on which they had not previously been observed in Ceylon included *Icerya purchasi*, Mask., on *Indigofera endecaphylla*, *Nezara viridula*, L., on *Sesamum indicum*, *Apoderus tranquebaricus*, F., on guava (*Psidium guayava*), and *Cyclosia panthona*, Cram., on *Hydnocarpus* sp.

Owing to the drying up of the trees by drought, the development of the lac insect [*Laccifer lacca*, Kerr] on *Zizyphus jujuba* and *Schleichera trijuga* has been irregular, the life-cycle shorter, and less brood-lac has been formed. Cultivation of lac on *Zizyphus* will not be continued, as it was inferior to that cultivated on *Schleichera*.

VAN DER VECHT (J.). **Proeven met derris tegen insectenplagen in Nederlandsch-Indië.** [Experiments with Derris against Insect Pests in the Netherlands Indies].—*Landbouw* **11** pp. 401–465, 5 figs., 24 refs. Buitenzorg, 1936; also as *Korte Meded. Inst. PlZiekt.* no. 21. Buitenzorg, 1936. (With Summaries in English.)

The following is largely taken from the summary. The derris dusts used in most of the tests were finely ground roots of *Derris malaccensis*, yielding 1 per cent. rotenone and 24 per cent ether extract, or those of *D. elliptica*, yielding 1–11·2 and 10–25 per cent., respectively. When applied in the form of dusts, they were mixed with talc, which was cheap and adhered well. It was repeatedly noticed that a mixed dust with a given rotenone content was more effective if it was prepared from roots that yielded a relatively low percentage of rotenone. This is ascribed to the relatively higher percentage of total extractives and to the increased chances of contact with a less diluted dust. Sprays were readily prepared by mixing a derris dust with water to a paste, which was then further diluted to the required strength. In some cases a spreader was added. Van der Laan has found soap to decrease the toxicity of derris [*R.A.E.*, A **23** 354], but Agral or some other spreaders, such as the juice of the fruits of *Sapindus rarak*, may be used.

Cabbages infested with *Plutella maculipennis*, Curt., and *Crocidolomia binotalis*, Zell., were treated weekly in the field with dusts containing 0·5 and 1 per cent. rotenone, and the yield was about three times as much as from untreated plots and twice as much as from plots where the larvae had been collected by hand. A maximum of about 5½ lb. of dust is required for 100 cabbages during the entire growth period. Sprays were less satisfactory. Against *Artona* (*Brachartona*) *catoxantha*, Hmps., on coconuts, a dust containing 1 part derris (11 per cent. rotenone) and 10 parts talc gave better results than a pyrethrum dust,

and in another field test dusts containing 0·5–1 per cent. rotenone killed about 90 per cent. of the larvae. In laboratory tests some parasites of *A. catoxantha* were killed by passing over leaves dusted a week previously. Promising laboratory results were obtained with derris dusts against *Herse convolvuli*, L., *Cricula trifenestrata*, Helf., *Achaea janata*, L. (*Ophiusa melicerta*, Drury) and Limacodids, but dusts with 0·5–2 per cent. rotenone only partially controlled *Utetheisa* spp. A dust with 0·5 per cent. rotenone gave complete control of *Brithys crini*, F., and *Calogramma festiva*, Don., on Amaryllidaceae in a garden at Buitenzorg. Dusting or spraying had little effect on *Laphygma exigua*, Hb., and *Prodenia litura*, F.; and *Heliothis armigera*, Hb. (*obsoleta* F.), proved very resistant [*cf.* **23** 528, 529]. High kills of adults and larvae of *Epilachna* spp., which attack solanaceous plants, were obtained with dusts containing 0·5 per cent. rotenone. A dust with 1 per cent. was not effective against *Plagiodera inclusa*, Stål, on soy beans, but various Halticids appeared much less resistant. *Ceratia flavomarginata*, Duv., on cucurbits was very susceptible, adults being killed by sprays containing 0·005–0·01 per cent. rotenone and by dusts containing 0·25–0·5 per cent. Adults and larvae of the coconut Hispid, *Brontispa longissima*, Gestro, were killed when wetted with suspensions containing 0·01–0·005 per cent. rotenone. *Plesispa reichei*, Chap., was less susceptible, the larvae being killed by a suspension containing 0·02 per cent. rotenone, but not the adults. Injurious bugs, such as *Eurydema pulchrum*, Westw., on cabbage, *Dysdercus cingulatus*, F., on cotton, *Leptocorisa acuta*, Thnb., on rice, and *Elasmognathus hewitti*, Dist., on pepper [*Piper nigrum*] were killed by spraying, and infestation of pepper by *Dasynus piperis*, China, was reduced by about 97 per cent. with a dust containing 1·5 per cent. rotenone and by about 94 per cent. with a spray containing 0·04 per cent. Suspensions containing 0·005–0·02 per cent. rotenone are effective against leaf Aphids, but experiments with sprays against Coccids and with sprays and dusts against *Agromyza* (*Melanagromyza*) *phaseoli*, Coq., on native pulses did not give promising results. Of some ants tested, *Dolichoderus bituberculatus*, Mayr, appeared to be very susceptible, being killed by a dust with 0·5 per cent. rotenone or a spray with 0·01 per cent. Derris also acted as a repellent against ants.

Smith (A. J.). **False Codling Moth and Fruit-fly as Pests of Citrus in the Western Transvaal.**—*Fmg in S. Afr.* 1936 reprint no. 37, 2 pp. Pretoria, May 1936.

Two seasons' observations (ending in June 1933) in western Transvaal showed that *Argyroploce leucotreta*, Meyr. (false codling moth) was a more important pest of *Citrus* than the fruit-flies, *Ceratitis capitata*, Wied., and *C. rosa*, Ksh. In both seasons, the fruits that dropped from selected trees in an orange orchard were examined periodically to determine the cause of dropping. In one orchard, the yield was large and the fallen fruit was picked up and destroyed, although not at regular intervals. In the second, the crop was light, and consequently the infestation relatively more heavy, and no orchard sanitation was practised. In the first orchard, 9·8 per cent. of the fruits of one variety dropped and 4·4 per cent. of another; 52·8 and 43·9 per cent. of these respectively were damaged by *A. leucotreta*, and 3·9 and 4·7 per cent. by fruit-flies. In the second orchard, 14·1 per cent. of the fruits

dropped ; 83·2 per cent. of these were injured by *A. leucotreta* and 0·8 per cent. by fruit-flies. The percentage of larvae of *A. leucotreta* that had left the fruits during the weekly intervals between examinations varied from 0 to 64·3, with an average of 22·6.

Experiments on the control of *A. leucotreta* by means of sprays and baits have given poor results, and the only effective measure has been the destruction of fallen fruit and infested fruit from the trees, by burying it or immersing it in water. The percentage of larvae that left the fruit indicates that it should be collected twice a week.

Simmonds (H. W.). **Fruit Fly Investigations, 1935.**—*Bull. Dep. Agric. Fiji* no. 19, 18 pp., 4 pls., 14 refs. Suva, 1936.

Of the fruit-flies occurring in Fiji [*cf. R.A.E.*, A **24** 446], *Dacus* (*Chaetodacus*) *passiflorae*, Frogg., is the most important, *D.* (*C.*) *zanthodes*, Broun, being comparatively scarce. A single adult of a species allied to *D.* (*C.*) *distinctus*, Mall., has been taken at light in Suva. *D. passiflorae* infests many fruits, those preferred including guava (*Psidium guayava*), cherry guava (*P. cattleianum*) and mandarin ; oranges are seldom severely attacked. Two or more females have been observed to oviposit in the same puncture, which may contain 2–72 eggs. The presence of more than 24 eggs in one hole is probably due to this cause, as examination of the mature females showed that 12 was the maximum number in each ovary. At 77–84°F., the eggs hatched in 32 hours. In grapefruit and thickly skinned oranges, the newly hatched larvae were frequently unable to bore through to the pulp and died. In addition to delays caused by temperature or by starvation due to overcrowding or lack of nutritious food, larvae appear to undergo a check when moulting and some of them then develop more slowly, so that in the same medium there may be considerable variations in the length of the larval period. The food becomes less suitable for larvae that develop slowly, owing to the growth of fungi and bacterial decomposition. In breeding experiments, the minimum larval period was 7–10 days (varying in different batches) on papayas and ripe guavas, 12–16 days on oranges (in one case only 7 days), and 5 days on ripe rock melon. Possibly the rapidity of larval development depends on the concentration of sugar in the fruit, which may be masked by a high acid ratio. The larval period on ripe guava was $8\frac{1}{2}$ days and on green guava 13 days ; no such delay was found with oranges, except possibly mandarins. Dissection of infested fruit often showed many apparently dead larvae, but some of the latter revived on exposure to the air. In these cases the egg punctures appeared to have closed, and after hatching, the larvae (mostly in the early instars) were asphyxiated. When the fruit falls, the larva normally emerges and pupates in the soil, the pupal stage lasting 8–10 days.

Breeding of this fly and its allies in captivity is known to be difficult, but success was obtained by keeping 100–150 adults in a small cage, 12 × 10 × 9 ins., consisting of a framework with a glass window and door at the back, a detachable cloth top and bottom, and cellophane front and sides. The cages were placed with free air circulation at the bottom. The flies were given water in a wick and fed on a mixture of fruit juice and water (1 : 2) with a little sugar, applied in drops on suspended fig-leaves or by means of a saturated plug of cotton-wool. This was varied occasionally with honey and water (1 : 5), and for

oviposition sections of ripe papaya and green cucumber about $\frac{1}{8}$ in. thick were supplied daily on a piece of glass.

Limited collections of pupae showed that incidence of the two native Braconid parasites, *Biosteres* sp. and *Opius* [*fijiensis*, Fullaway (**24** 535)] was high, although not reaching the 25 per cent. previously recorded. During the season *Opius* increased in numbers until it dominated *Biosteres*. Predators observed included the Lygaeid, *Germalus pacificus*, Kirk., which sucked the eggs. No further recoveries of the introduced Eulophid, *Tetrastichus giffardianus*, Silv., were made in the district where parasitism had reached 20 per cent. [**24** 447], and it is probable that the parasite was not sufficiently established to withstand the scarcity of the host between October and January. Further recoveries were made at Tamavua from colonies released after conditions had improved. The life-cycle of the parasite occupied about 21 days from egg to egg, and 90–120 or more eggs were deposited within about 4 days ; the life-cycle of the host takes about 30–33 days. In rearing experiments the average number of parasites that emerged from one host was 7, although in one case 36 emerged. A small colony of *Opius humilis*, Silv., received from Hawaii was also released.

Eggs of *Dacus xanthodes* hatched in 30–40 hours, and the larval and pupal stages lasted 6–9 and 11–12 days, respectively. This Trypetid was bred by the same technique as *D. passiflorae*. It oviposited in guavas but not in cucumber or papaya.

Jacques (C.). **Le papillon suceur de fruits.**—*Rev. agric. Nouv. Calédonie* 1936 pp. 2263–2265, 3 figs. Nouméa, 1936.

During 1936, serious damage was caused to fruits, particularly oranges, in New Caledonia by a fruit-piercing moth (*Othreis* sp.), the larva and adult of which are briefly described. The larvae feed principally on leaves of *Erythrina*. Trees on which they are numerous should be sprayed with lead arsenate (1 lb. to 15 gals. water), and the adults might be poisoned by mangos or similar fruits dipped in syrup in which sodium arsenite (4 per cent.) has been dissolved. An electric light attracted large numbers.

Wolcott (G. N.). **" Insectae Borinquenses." A revised annotated Check-list of the Insects of Puerto Rico, with a Host-Plant Index by J. I. Otero.**—*J. Agric. Univ. P.R.* **20** no. 1 pp. 1–627 (+ 3), 120 refs., illus. Rio Piedras, P.R., July 1936.

This is a revised and greatly enlarged edition of a catalogue already noticed [*R.A.E.* A **12** 251]. Descriptions of new species by various authors are included. Amongst the new Aleurodids described by Dozier is *Aleurodicus antillensis*, which occurs on coconut palms, *Calophyllum antillanum* and *Erythrina glauca*. Indices to genera and food-plants are appended.

Hurd-Karrer (A. M.) & Poos (F. W.). **Toxicity of Selenium-containing Plants to Aphids.**—*Science* **84** no. 2176 p. 252, 6 refs. New York, 11th September 1936.

In the course of certain experiments in the United States on the effect on wheat of selenium taken up from the soil, it was observed that *Rhopalosiphum prunifoliae*, Fitch, does not attack plants injured by the selenium. Experiments were therefore carried out to determine

whether the Aphids found the plants distasteful and left them, or whether they died as the result of sucking the plants. It is concluded from the results that they are killed by selenium taken up by the plants from small amounts in the substratum. They were sensitive to concentrations too low to affect visibly the plants themselves.

VESEY-FITZGERALD (D.). **Insects attacking Sugar-cane on the Island of Tobago.**—*Trop. Agriculture* **13** no. 8 pp. 199–200, 6 refs. Trinidad, August 1936.

Sugar-cane in Tobago is attacked by *Tomaspis carmodyi*, Kershaw, and *Diatraea canella*, Hmps. The former is not sufficiently abundant to cause froghopper blight [*cf. R.A.E.*, A **9** 261], perhaps because the system of cultivation employed prohibits the production of large unbroken areas of cane. Its nymphs have been found feeding on the native grasses, *Paspalum polygonatum* and *Axonopus compressus*, and on the introduced *Eleusine indica*. *D. canella* is recognised as a pest by the planters, but appears to cause little actual damage.

WOOD (R. Cecil) & JAMES (H. M.). **Cauliflower Cultivation in the Tropics.**—*Trop. Agriculture* **13** no. 8 pp. 218–220, 4 figs., 4 refs. Trinidad, August 1936.

During experiments in Trinidad on the cultivation of cauliflowers for export, the young plants were very severely attacked by the Pyralid *Hellula phidilealis*, Wlk. Most of the eggs were deposited on the upper surface of the leaf. The larvae hatched in 4–6 days and at once made their way into the leaf, where they remained for about 4 days. They then moved down into the bud, boring into it and covering themselves with a web. After 15 days, during which time they severely damaged or destroyed the bud, they entered the soil and pupated a few inches from the plant. The pupal period lasted 10–11 days. *Brassica sinensis* was found to be an important alternative food-plant.

Climatic conditions are unfavourable for the cultivation of cauliflowers planted during the first half of the year, and a long interval between crops would be of value in the control of *Hellula*. Other crucifers should be eliminated from the neighbourhood so far as possible and infested plants should be destroyed. Continuous hoeing considerably reduces the numbers of pupae. A spray of lead arsenate applied twice weekly was not so efficient as a dust of Paris green and lime, 1 : 16.

KATSURA (S.). **The Stunt Disease of Japanese Rice, the first Plant Virosis shown to be transmitted by an Insect Vector.**—*Phytopathology* **26** no. 9 pp. 887–895, 21 refs. Lancaster, Pa, September 1936.

The history of the occurrence of stunt disease (commonly called dwarf disease) of rice in Japan is given [*cf. R.A.E.*, A **22** 374, etc.], and references in the literature are discussed, including mentions of leafhoppers as possible vectors. It is now known that *Nephotettix bipunctatus*, F. (*apicalis*, Motsch.) is the only leafhopper capable of transmitting the disease, though how the virus is carried in the insect's body is as yet unknown.

Whipple (O. C.). **Spotted Wilt of Garden Pea.**—*Phytopathology* **26** no. 9 pp. 918–920, 1 fig., 6 refs. Lancaster, Pa, September 1936.

In the course of a study of pea streak in Wisconsin in 1934 examples of *Thrips tabaci*, Lind., were transferred to healthy pea plants from nasturtiums infected with pea streak and from nasturtiums infected with spotted wilt. The symptoms that developed on the pea plants in both cases appeared to be identical and typical of pea streak. In view of the fact that the virus of spotted wilt is widely distributed, it is undoubtedly a common causal factor in pea streak.

Doolittle (S. P.) & Alexander (L. J.). **Injury to Greenhouse Tomatoes as a result of combined Infection with the Viruses causing Tomato and Cucumber Mosaic.**—*Phytopathology* **26** no. 9 pp. 920–923, 2 figs. Lancaster, Pa, September 1936.

In the spring of 1935, instances were recorded from Ohio and Colorado of tomatos in greenhouses being severely injured by a combined infection with ordinary tomato mosaic and cucumber mosaic. Owing to its rapid dissemination by mechanical means, tomato mosaic is so prevalent on greenhouse tomatos that the introduction of another virus is almost certain to result in combined infection. Aphids are apparently chiefly responsible for the dissemination of cucumber mosaic. In the autumn of 1935, the combined infection in a greenhouse in Ohio was evidently the result of Aphids carrying the cucumber virus from cucumbers in the field.

Smith (M. R.). **Distribution of the Argentine Ant in the United States and Suggestions for its Control or Eradication.**—*Circ. U.S. Dep. Agric.* no. 387, 39 pp., 24 figs., 19 refs. Washington, D.C., May 1936.

The history of *Iridomyrmex humilis*, Mayr (Argentine ant) in the United States, its habits and response to ecological factors, the damage it does and the means by which it spreads, are described from the literature. A survey to determine its distribution and abundance was made from the autumn of 1931 to the spring of 1933. The survey covered towns in 18 southern and eastern States. Approximately 4,000 sq. miles, lying almost entirely in the southern States and California, were found to be infested, and the area of infestation is considered likely to increase. Although *I. humilis* is a tropical insect, prevented from spreading northwards by prolonged, severe winters, it appears to be more tolerant of cold than any other ant in the south, with the exception of *Prenolepis imparis*, Say. It is very susceptible to winds and, though it requires moisture, was never seen in water-logged habitats.

Mississippi was the first State to organise the control of *I. humilis* [*R.A.E.*, A **12** 585; **13** 622; **17** 524], and regular campaigns were carried out there as early as 1920. In 1933, the author and L. C. Murphree investigated the methods used in this State and the effectiveness of the suppression campaigns. These had freed 39 out of 245 infested localities and reduced infestations in nearly all others. The procedure was to delimit the infested areas by scouting when the temperature was above 70°F., dispose cups of poison in these areas and leave them for the whole season. During the course of the work in Mississippi, 3 types of containers have been used: tin cans, aluminium

cups and cups made of heavy paraffined paper. The tin cans were discarded on account of cost. The aluminium cups are light and easily transported and can be used for more than one year, but they are not large enough to keep the syrup from drying up, are easily submerged, and their cost is about 1½ times that of the paper cups, which were ultimately adopted. These resemble small drinking cups with lids and hold approximately 1½ fl. oz. There are 4 small holes for the ants near the top but beneath the lid. The poison is a syrup containing sodium arsenite [**8** 285], which should meet the following specifications: sodium arsenite 0·16 per cent., tartaric acid 0·06 per cent., solids 50·0° Brix. It should not be exposed to exceedingly low or high temperatures and should never be placed in a receptacle that has contained oil, kerosene, or grease, which are very repellent to ants. The cups are usually suspended on brackets and should be placed 20–25 ft. apart, 5-6 ft. from the ground on houses and 6 ins. from the ground on the outside of fences enclosing livestock, and concealed as much as possible. They can also be set in the crowns of dense plants or partly buried in well-drained soil and covered with clods of earth. It is desirable to poison 50–75 ft. beyond the limit of infestation. Poisoning is best carried out in the autumn or winter, when honey-dew is scarce and a temperature of 50–60°F. stimulates feeding. The greatest reduction in the number of ants takes place during the first 2 months. In the summer following the first campaign in a given locality, 95–100 per cent. of the reports are usually satisfactory. The same quantities should be used for the second year, and according to the reports obtained it can be determined to what extent the quantity of supplies can be reduced in the third campaign. Usually 3–5 campaigns are necessary to effect eradication. Intensive scouting should be continued for 2 summers after the area appears to be free from ants.

Eradication may be hastened by burning movable wood containing colonies of ants and pouring kerosene on tree stumps and setting fire to them. Digging colonies out of the soil and burning them is very expensive and only practicable where eradication is almost complete.

Barber (G. W.). **The Corn Ear Worm in southeastern Georgia.**—*Bull. Ga Exp. Sta.* no. 192, 18 pp., 8 figs. Experiment, Ga, 1936.

An account is given of the life-history of *Heliothis armigera*, Hb. (*obsoleta*, F.) as a pest of maize in south-eastern Georgia. The larvae are polyphagous [*R.A.E.*, A **24** 295], and although maize is the preferred food-plant, two weeds occupy an important place in the life of the insect. *Linaria canadensis* supplies food for the larvae early in the season, before the maize is large enough to be attacked, and *Meibomia purpurea* does so during August, September and October, after it has ripened. The period of emergence of adults from overwintered pupae is very protracted, lasting from the end of March until late July, so that the number of generations passed through in one season may vary from six to one. The last larvae pupate in the soil in early October. In ears with long tight husks the larvae reduce their numbers by cannibalism [**24** 304]. Predators include *Orius insidiosus*, Say, which destroys large numbers of the eggs [**24** 368], and *Solenopsis geminata xyloni*, McCook, which attacks the larvae when they have left the ears for the soil prior to pupation. *Trichogramma minutum*, Riley, is an important egg parasite [**24** 733]. Methods of control include the selection of varieties that have the husk wrapped

tightly about the ear, planting in a fertile soil to ensure rapid and vigorous growth, and autumn ploughing to destroy the hibernating pupae.

Stearns (L. A.), Haden (W. R.) & Williams (L. L.). **Grape Leafhopper and Grape-berry Moth Investigations.**—*Bull. Del. agric. Exp. Sta.* no. 198, 44 pp., 16 figs., 5 refs. Newark, Del., 1936.

The first part of this paper deals with the results of studies carried out from 1925 to 1935 on *Erythroneura comes*, Say, infesting grapevines in Delaware. The effects of climatic factors on the life-cycle [*R.A.E.*, A **19** 554] were confirmed by the observations made [*cf.* **21** 227]. The adults hibernate to some extent in piles of dead leaves and rubbish in and about the vineyards, but most of them were found in the moist layer between the wet and dry sections of the leaf mat in the neighbouring woods of deciduous trees. In April and early May they move to low-growing plants, which provide the shelter from the wind that is needed during the transition period from complete hibernation to the initiation of feeding and breeding on the vines. A list of 67 species of plants examined to determine whether they were alternative food-plants is given ; no breeding and little feeding were observed on any of them. A conspicuous movement of the adults into the vineyard occurred each year about the middle of May. About a month was required for the development of each of the two broods that develop annually. The egg stage averaged 14·21 days, and the 5 nymphal instars 17·46. By the first week in July, the majority of the first-brood nymphs were in the third instar, and a special spray should then be applied. Experiments showed that nicotine sulphate, if used at a dilution of 1 : 400 or 1 : 800, preferably in combination with some wetting agent, and certain rotenone and pyrethrum sprays as well, will provide adequate control [*cf.* **21** 589 ; **23** 599]. The time of application must be determined by observations each year on the peak of nymphal activity. Apart from weather conditions, the most important factor in natural control is the fungus, *Entomopthora sphaerosperma*.

The second part of the paper deals with the use of sprays for the control of *Polychrosis viteana*, Clem., a serious pest of grapes in localised areas in Delaware. Previous information on its life-history [**21** 48, etc.] has been supplemented and is presented in the form of tables. Two complete broods and a partial third develop annually. Effective control of the first-brood larvae was obtained by three applications of a spray of 4 lb. lead arsenate and 1 U.S. pint fish oil in 100 U.S. gals. Bordeaux mixture. The first application is made when not more than 10 per cent. of the blossoms are out, the second just as the blossoms fall and the third, or " ten-day " spray, just before the grapes touch in the cluster. With lead arsenate, the addition of fish oil at the rate of 1 pint and 1 quart per 100 gals. raised the percentage of uninjured berries from 62 to 74 and 87, respectively. In 1933 and 1934, calcium arsenate substituted for lead arsenate in different combinations of treatments gave practically the same degree of control and reduced considerably the arsenical load on the berries.

The peak of activity of the second-brood larvae is about six weeks prior to harvest. A supplemental spray of 4 lb. lead arsenate and 8 lb. lime per 100 U.S. gals. water increased the percentage of uninjured berries by 10·5 for the three years 1931–1934. Foliage growth and cluster

development limit the effective application of sprays at this time, and heavy spraying would result in serious residue complications. A complete spray programme for fungous diseases and insect pests is given.

HEADLEE (T. J.). **Japanese Beetle Control in Commercial Fruit Plantings.**—*Circ. N. J. agric. Exp. Sta.* no. 366, 7 pp. New Brunswick, N.J., June 1936. **Japanese Beetle** (*Popillia japonica*).—*Op. cit.* no. 367, 8 pp., 2 figs.

In the first circular, recommendations are made for protecting fruit crops from injury caused by the adults of *Popillia japonica*, Newm. Three sprays are advocated, composed respectively of 6 lb. powdered acid lead arsenate and 4 lb. cheap wheat flour [*R.A.E.*, A **22** 633], 20 lb. hydrated lime and 3 lb. aluminium sulphate [**24** 529], and 3 lb. ground derris root (4–5 per cent. rotenone and 16–18 per cent. total acetone extractives) and 3 lb. resin residue emulsion [**24** 727], all in 100 U.S. gals. water. The methods of preparing the emulsion and sprays are given in detail. The third spray alone leaves no residue. Good coatings of all should be applied just before beetle attack begins and maintained throughout the period of flight. This will involve repetitions of the spray in the case of hydrated lime. The first applications of lime and derris should be made when beetles appear on weeds near the orchard. A film coating of lead arsenate on 25th June is recommended for non-bearing apple and cherry trees and late varieties of apples, and a similar spray, as soon as the fruit has been picked, for bearing cherry trees. If lime-sulphur is to be applied to cherry trees after harvest against leaf spot, 4 lb. lead arsenate and 4 lb. wheat flour should be added to each 100 U.S. gals., and the spray repeated 2 weeks later. Grape-vines can be protected by lead arsenate applied as soon as adults appear on weeds, and again when there is a growth of new foliage. Hydrated lime and aluminium sulphate, which is practically non-poisonous, should be used for apple trees if poison is undesirable or arsenical damage to foliage is feared, for non-bearing peaches and late varieties until 15th July, after which date the residue becomes objectionable, and for non-bearing plums and bearing ones unless residue on fruit is feared. Either lead arsenate or lime is suitable for non-bearing raspberries, blueberries and blackberries, to which it should be applied on 25th June, and bearing bushes of these fruits after harvest. The derris spray should be used on early peaches and repeated at 7–10 day intervals until attack ceases, if necessary until one week before picking. It may be used and repeated at the same intervals on plums if residue from aluminium sulphate and lime is feared. It might also be used for grape-vines, but would be more expensive than lead arsenate. All prematurely ripe and rotting apples and peaches should be destroyed, as they attract the beetles. In the case of the cultivated blueberrry, adequate protection has been obtained by knocking the beetles off the plants into containers in the early morning. For strawberries, hydrated lime will protect the foliage, but they merit special attention as the roots are liable to severe damage by the larvae, whereas those of other fruit crops are not. If the larvae are present, they cannot be controlled, but oviposition does not occur to any extent if the beds are kept clear of weeds and grass. Strawberries should not be planted in ploughed grass-land unless it has been kept fallow during the preceding season.

In the second circular, the distribution of *P. japonica* in the United States in 1935 is reviewed, and notes are given on its bionomics and

control, and the nature and extent of the injury it causes. Partial lists of plants attacked by the adults and of plants observed to be free or practically free from attack except in exceptional circumstances are included. The measures recommended against the larvae include the use of lead arsenate for treating lawns, and soil fumigation with carbon bisulphide or carbon bisulphide emulsion. Oviposition in plots for vegetables should be prevented by clearing them of attractive plants at the season of flight. A rotary tiller will reduce the numbers of larvae in infested soil sufficiently to permit the cultivation of a crop. Sweet maize is the only vegetable that is extensively injured by the adults; the silks should be kept coated with hydrated lime during the flight period.

CRESSMAN (A. W.) & DAWSEY (L. H.). **The comparative Insecticidal Efficiency against the Camphor Scale of Spray Oils with different Unsulphonatable Residues.**—*J. agric. Res.* **52** no. 11 pp. 865–878, 3 figs., 8 refs. Washington, D.C., 1936.

The following is largely taken from the authors' summary:—The comparative insecticidal value of three petroleum oils, with 6, 16, and 33 per cent. by volume, respectively, of sulphonatable material, was investigated in laboratory and field spraying tests in Louisiana in 1932. The oils were applied in the form of emulsions containing from 0·9 to 2·0 per cent. oil, sodium oleate soap being used as the emulsifier, to potted plants and trees of camphor (*Cinnamomum camphora*) infested with *Pseudaonidia duplex*, Ckll. The other characteristics of the different oils were substantially the same, so that any detectable differences in mortality could be due only to differences in the sulphonatable portions.

When sprays that gave equal oil deposits were compared, the variations in mortality appeared to be entirely random, and no differences were found that could be attributed to the sulphonatable content of the oils. Analyses of the oil deposits (which are expressed by figures representing c.c. $\times 10^{-5}$ per sq. cm. of leaf surface) showed that substantially equivalent deposits were obtained when equal concentrations of the different oils were applied. In the laboratory tests, the deposits were independent of the sulphonatable content of the oil, but varied directly with the oil content of the spray, ranging from 3·8 for a 0·9 per cent. emulsion to 6·7 for a 1·7 per cent. emulsion. In the field, with emulsions containing 2 per cent. oil, the deposits ranged from 9·5 to 10·1.

The population density of the scales was measured by the percentage of twig area covered. The average percentages surviving at the different population densities in the laboratory tests ranged from 29 at 5 to 90 at 75 for sprays containing 0·9 per cent. oil, from 15 at 5 to 67 at 75 for those containing 1·5 per cent., from 21 at 5 to 80 at 95 for those containing 1 per cent., and from 9 at 5 to 59 at 95 for those containing 1·7 per cent. In the field tests, where 2 per cent. emulsions were used, the oils containing 6 and 33 per cent. of sulphonatable material killed the same proportion of scales, the percentage survival ranging from 25 to 78 over the entire range of population density, while for the oil containing 16 per cent. of sulphonatable material the percentage survival was from 36 to 96.

No conclusion as to the effects of the oils on the plants was drawn from the laboratory tests, as the results would not be typical of reactions under field conditions. In the field tests, the trees sprayed with

2 per cent. emulsions made with oil containing 33 per cent. of sulphonatable material showed a leaf drop of 75–80 per cent. when observed 10 weeks after the spraying date. Those sprayed with the oils of lower sulphonatable content had a maximum leaf drop of less than 10 per cent.

Ingram (J. W.) & Summers (E. M.). **Transmission of Sugarcane Mosaic by the Rusty Plum Aphid,** *Hysteroneura setariae.*—*J. agric. Res.* **52** no. 11 pp. 879–887, 5 refs. Washington, D.C., 1936.

In preliminary surveys in Louisiana in 1930 to ascertain the degree to which *Aphis maidis*, Fitch, was associated with sugar-cane mosaic, the rusty plum aphis, *Carolinaia* (*Hysteroneura*) *setariae*, Thos., was found to be the most abundant Aphid occurring on sugar-cane. *A. maidis* was the only proved vector of the disease, and *C. setariae* did not transmit it in a small scale test in Cuba [*R.A.E.*, A **22** 151], but cage experiments carried out from 1933 to 1935 and described in this paper showed that the latter may also be a vector.

The following is largely taken from the authors' summary: *C. setariae* is generally distributed on plums throughout most of the United States, with grasses as alternate hosts. On sugar-cane, it usually feeds at the collar lobe at the junction of the leaf blade and the sheath. In three series of experiments in which Aphids from plants infected with mosaic were transferred to healthy ones, *C. setariae* transmitted the disease to 24 plants out of 419 and *A. maidis* to 17 out of 72. Two transfers of mosaic were made by the feeding of *Toxoptera graminum*, Rond., after the exposure of 28 healthy plants. This Aphid was found on sugar-cane in some fields in 1934. Negative results were obtained from transferring the following insects from infected to healthy sugar-cane plants, the numbers of the latter being shown in brackets after each: *Sipha flava*, Forbes (8), *Draeculacephala mollipes*, Say (102), *Sogata furcifera*, Horv. (5), and *Haplothrips graminis*, Hood (17). In a limited number of direct comparisons the incubation period of the disease was longer after transmission by *H. setariae* than by *A. maidis*; this is possibly accidental, but might be accounted for by the fact that the latter feeds on the young leaf whorl and the former at the collar lobe, which is less directly connected to the growing point. *C. setariae* is present and feeding on the cane throughout the year, whereas *A. maidis* is present only in the winter and early spring.

Flemion (F.) & Hartzell (A.). **Effect of Low Temperature in shortening the Hibernation Period of Insects in the Egg Stage.**—*Contr. Boyce Thompson Inst.* **8** no. 2 pp. 167–173, 10 refs. Yonkers, N.Y., 1936.

During 1934 and 1935, experiments carried out in New York State showed that eggs of certain insects hibernating in the egg stage require, for physiological reasons, a period of low temperature before hatching in the spring. At various intervals from the time of laying until the spring, collections were made of the egg-masses of *Malacosoma americana*, F., which are laid in July and contain about 300 eggs each. The egg-masses were subjected to constant temperatures ranging from 1 to 35°C. [33·8–95°F.] for periods varying from 2 to 45 weeks and then transferred to room temperature, about 22°C. [71·6°F.]. No larvae hatched from egg-masses collected in autumn

and kept constantly at room temperature or exposed to higher temperatures, or from those kept at lower temperatures for 4 weeks or less, or for 45 weeks. In the case of egg-masses kept at 1, 5, 10 and 15°C. [33·8, 41, 50 and 59°F.], the average numbers of larvae hatching per mass from 4 egg-masses were 57, 22, 0 and 0 when the duration of exposure was 6 weeks, 139, 133, 78 and 0 when it was 8 weeks, and 197, 200, 242 and 5 when it was 12 weeks.

In tests on eggs collected in July, there was no increase in the number of eggs hatching after periods of constant temperature longer than 2 weeks (when a few eggs that had been kept at 1 and 5°C. hatched). When the egg-masses were collected from the field late in January, so that they had been subject to natural low temperatures, an average of 207 larvae hatched from each. The numbers hatching were lower for egg-masses collected earlier in the winter and higher for those collected later. The time at room temperature required for 50 per cent. of the total number of larvae to hatch decreased progressively with the duration of exposure of the egg-masses to cold; 37, 10, and 3·5 days respectively were required for egg-masses collected on 11th December, 15th February and 17th March. Eggs were hatching in the field on 1st April. Since the eggs do not hatch unless exposed to low temperature, for an adequate test of the ovicidal action of any spray they must be exposed to low temperature either before or after the applications are made.

Similar results were obtained with egg-masses of *Alsophila pometaria*, Harr., which are laid in the autumn, though a few larvae hatched from eggs maintained at room temperature throughout the winter. A similar treatment of the egg-masses of *Paratenodera sinensis*, Sauss., gave no indication that the eggs of this mantis require exposure to low temperatures. This was to be expected, as it is not indigenous, but was accidentally introduced from the warmer regions of the Orient. The eggs are laid in October on low shrubs, and probably hatch as soon as they receive the minimum hatching temperatures in the spring.

LINDGREN (D. L.). **The Respiration of Insects in Relation to the Heating and the Fumigation of Grain.**—*Tech. Bull. Minn. agric. Exp. Sta.* no. 109, 32 pp., 15 figs., 35 refs. St Paul, Minn., September 1935. [Recd. 1936.]

A summary is given of previous work on the heating of grain, showing that it may be due to respiration of the grain itself if it is stored under moist conditions and may also result from infestation by insects [*cf. R.A.E.*, A **22** 129; **23** 676, etc.], and the materials and methods used in the present study are described in detail. The insects used were adults of *Calandra* (*Sitophilus*) *oryzae*, L., and *C.* (*S.*) *granaria*, L., and the experiments showed that the chief factors causing insect-infested grain to heat were the production of heat and metabolic water as end products of insect respiration. The amount of carbon dioxide produced by wheat increases rapidly at a moisture content above 14 per cent., the seat of oxidative activity probably being the embryo. The output of carbon dioxide by the weevils was affected by the moisture content of the wheat; when this was below 14 per cent. the loss in weight and mortality of the weevils was high. At any given moisture condition, length of life decreased with an increase in temperature. It was confirmed that *C. oryzae* is more sensitive to dryness

in wheat than *C. granaria* [**16** 252]. When the moisture content of the wheat was 14 per cent., or higher, the carbon dioxide output was greater for the former, weight for weight [*cf.* **8** 178], but at a moisture content of 10·7 or 8·7 per cent. it was greater for the latter. The insects were most active at 35°C. [95°F.].

When the wheat had a moisture content of 15·2 per cent. or less, the quantity of heat evolved as evidenced by the rate of respiration was much greater for the insects than for the wheat, but the rate for wheat approached that for the insects when the moisture content was as high as 17·4 per cent., 100 gm. wheat (dry basis) being compared with 70 adults of *C. granaria* or 100 of *C. oryzae* (approximately equal in weight). These infestations are not high as compared with the potential population under favourable conditions. The heating of grain at moisture contents that are not extreme is a long drawn out process whereby small units of heat tend to accumulate, the process becoming more and more rapid as the temperature increases. It is probable that insects may initiate this process in wheat that contains 14–16 per cent. water and greatly shorten the time that it takes the wheat to reach dangerously high temperatures.

The second part of the paper deals with the relation between insect respiration and the toxicity of fumigants. Previous work is discussed. A rise in temperature and a moderate increase in the carbon dioxide content of the atmosphere surrounding the insect are two factors that increase the rate of respiration, and it is generally thought that toxicity depends upon this [**20** 696]. The experiments were made with adults of the two weevils and all stages of *Tribolium confusum*, Duv. They showed that *C. oryzae*, weight for weight, respired more rapidly than did *C. granaria* and was more susceptible to carbon bisulphide and chloropicrin ; they were, however, both equally susceptible to ethylene oxide [*cf.* **20** 696]. Adults of *T. confusum* had a higher rate of respiration than the weevils, but a higher concentration of carbon bisulphide or ethylene oxide was needed to kill them. *C. granaria*, however, was more resistant to chloropicrin. The metabolic rates of an insect vary, the carbon dioxide output of old adults of *T. confusum* being very high in comparison with adults less than four days old. That of the egg and pupa was low in comparison with that of the larva and adult. The pupae seemed to be more stable than the adults and larvae in their resistance to the three fumigants tried ; with chloropicrin they were least resistant at the beginning and at the end of the pupal stage. The larvae were the most susceptible to carbon bisulphide and chloropicrin, and were second to the egg in susceptibility to ethylene oxide. They had the highest rate of respiration next to the adults. Young adults were more resistant to carbon bisulphide, but young and old were equally susceptible to chloropicrin. Only the egg and pupal stages were affected by differences in the relative humidity at the time of fumigation, a low humidity favouring a greater resistance [**20** 416]. Adults of *T. confusum* showed an increased susceptibility to carbon bisulphide and chloropicrin as the temperature rose.

CUPPLES (H. L.). **Wetting and Spreading Properties of Aqueous Solutions. Oleic Acid-Sodium Carbonate Mixtures.**—*Industr. Engng Chem.* **28** pp. 60–62, 1 fig. Easton, Pa, 1936.

In continuation of previous investigations on the wetting and spreading properties of aqueous solutions [*R.A.E.*, A **24** 213], sodium

carbonate was used instead of sodium hydroxide in mixtures with oleic acid. The procedure was the same, except that with a few of the solutions it was necessary to filter off the suspended solids before measuring the surface and interfacial tensions. At higher concentrations no difficulties were encountered, but at the concentration of 0·1 gm. oleic acid per 100 cc. solution, and at the lower alkali-fatty acid ratios where considerable suspended solid was apparent, erratic results were obtained in the measurement of interfacial tension. Filtration through ordinary commercial filter paper removed the less finely dispersed solids, but not the colloidally dispersed material. After filtration, the surface tensions were practically unchanged, but the interfacial tensions against oil were higher and reproducible. It is thought that the less finely dispersed solids in unfiltered solutions interfere with the measurement of interfacial tensions, without contributing to the wetting power of the solutions. Results for three alkali-fatty acid ratios are given and briefly discussed. The variation of spreading coefficients was less pronounced than in the case of the sodium hydroxide mixtures, as was particularly evident at the higher concentrations. It is concluded that as an alkali for use with oleic acid in the preparation of aqueous solutions with superior wetting properties, sodium carbonate has some definite advantages over sodium hydroxide. As at a given concentration the wetting properties of the carbonate mixtures are much less sensitive to variations in the alkali-fatty acid ratio, it should be easier to maintain a consistently high value of the spreading coefficient in the preparation of the solutions. There should also be less uncontrolled variation due to the acidity or alkalinity of the water used for diluting the mixtures.

MARKWOOD (L. N.). **Nicotine Peat, a new insoluble Insecticide.**—*Industr. Engng Chem.* **28** pp. 561–563, 1 fig., 5 refs. Easton, Pa, 1936. **A new Water-soluble Nicotine Insecticide—Nicotine Humate.**—*T.c.* pp. 648–649, 1 ref.

The desirability of obtaining insoluble nicotine insecticides for the control of chewing insects is recognised, and two such products, nicotine tannate and nicotine bentonite, have recently been developed. The first paper deals with the preparation of a third, which is the reaction product of nicotine and peat and is termed nicotine peat [*cf. R.A.E.*, A **24** 294]. An important ingredient of peat is a group of acidic substances known collectively as " humic acid," the constitution of which has not been established. This humic acid is combined, more or less according to environmental conditions, with basic elements, giving peats ranging from a pH of less than 4 to more than 7. It is due to the presence of free acid that peat is able to combine with nicotine, a fairly strong organic base. Nicotine peat was prepared by bringing together 20 gm. peat (first air-dried and ground to a 60 mesh) and 3 gm. nicotine in the presence of 100 cc. water. The reaction was conducted at atmospheric pressure and at a temperature of about 100°C. [212°F.], and 2 hours was generally allowed for each experiment, though the same results could be obtained in 15 minutes. After the reaction, the solid matter was separated and washed until the water showed only a negligible amount of nicotine. The product was then air-dried and ground to 200 mesh, in which condition it is suitable either for dusting or for use in a spray mixture.

The presence of acids during the reaction is to be avoided, as the nicotine content is lowered by them. It was raised by treating the peat with hydrochloric acid, before submitting it to the reaction, to remove the bases present and to liberate the free peat acids. Highly acid peats were superior to the less acid types, but too much importance should not be attached to the apparent correlation between pH and nicotine content, since acidity may in some cases be due partly to inorganic constituents and then it is not a measure of active organic matter upon which the reaction depends. In nicotine peat about 90 per cent. of the nicotine is insoluble in water. In this form it is incompatible with alkaline fungicides, and these should be neutral if it is to be applied together with them. Analyses of nicotine peats from various peat samples are given.

The second paper deals with nicotine humate, which was obtained by evaporating the liquid separated from nicotine peat. It is an amorphous black substance and forms a colloidal solution in water. Evaporation should be conducted at 60°C. [140°F.], as the residue partly decomposes at higher temperatures. The nicotine content of the nicotine humate ranges from 28 to 34 per cent. according to the type of humic material employed. A peat producing a good yield of nicotine humate may not produce a high grade of nicotine peat. The humate may also be prepared by using precipitated humic acid instead of peat. Details of this process are given.

Nicotine humate should be equivalent insecticidally to nicotine sulphate, and, being a solid, it can be handled and shipped in a dry state. Analyses of the nicotine content and yield of nicotine humate obtained from various peats are given.

EBELING (W.). **Effect of Oil Spray on California Red Scale at various Stages of Development.**—*Hilgardia* **10** no. 4 pp. 95–125, 11 figs., 11 refs. Berkeley, Calif., April 1936.

A detailed account is given of experiments on the effect of different grades of oil sprays against *Aonidiella aurantii*, Mask., on *Citrus* in California [*cf. R.A.E.*, A **16** 671; **20** 687]. The following is largely taken from the author's summary: Experiments confirmed that the ultimate effects of oil spray on the scale population is influenced by the inhibition of the settling of crawlers for some time after it is applied. Where the normal amount of oil was deposited in the application of oil spray under orchard conditions, there was a great reduction, for at least a month afterwards, in the percentage of crawlers able to settle on the foliage. Among those that had become whitecaps (crawlers covered with the waxy substance secreted after they have settled) during this period, there was a greater mortality than where the spray had not been applied. Various dusts inhibited settling of the crawlers in laboratory tests, but they could not be used effectively in the field because of the difficulty of covering both sides of all the leaves and the numerous applications required.

All immature stages of the scale were more easily killed by oil spray than the adult, probably because they are not so thoroughly attached to the substratum, and because their spiracles are closer to their margins and so more accessible to the oil [*cf.* **24** 168].

The adult scales are usually killed by tracheal penetration of the oil, although, at least on bark, death may occur without this happening. Those with their margins loosened from the substratum are most

vulnerable, but oil penetrates the armour to some extent. In two experiments, the armours of adult scales were painted with oil, care being taken that none should enter beneath the bodies of the insects. In 16 and 44 days respectively, 5·64 and 17·78 per cent. had been killed. Those alive at the end of two weeks gave birth to a certain number of dead embryos and crawlers; some of these were born before they had developed the usual appendages. The scales were found to live in an oxygen-free atmosphere for as long as 26 hours. Immersed in oil, they lived as long as 72 hours.

Scales on bark are the most difficult to control. Experiments are being made with substances that, when added to the oil spray, are expected to act as physical barriers to the penetration of oil by clogging the pores of the bark, and a quick-breaking emulsion of paraffin wax has been found to do this. When added to the oil spray separately, or combined with it in a single emulsion, it not only greatly increased the amount of oil deposited and resulted in a more even distribution of the oil over the leaf surface, but also increased the insecticidal efficiency of any given amount of oil deposited [**23** 652].

Shropshire (L. H.) & Kadow (K. J.). **Diseases and Insect Pests of Cabbage and related Plants: Identification and Control.**—*Circ. Ill. agric. Exp. Sta.* no. 454, 47 pp. 21 figs. Urbana, Ill., May 1936.

In the second part of this paper, Shropshire gives an account of the bionomics and control of the more important insect pests of cabbage and other crucifers in Illinois.

Groves (K.), Marshall (R. E.), Overley (F. L.) & St. John (J. L.). **The Removal of Fluorine Spray Residue from Apples sprayed with Natural Cryolite.**—*Bull. Wash. St. agric. Exp. Sta.* no. 329, 15 pp., 8 refs. Pullman, Wash., May 1936.

The use of fluorine compounds in sprays against the codling moth [*Cydia pomonella*, L.] on apples has increased considerably in Washington State during recent years, but has been limited by the difficulty of reducing residues to the United States tolerance of 0·01 grain fluorine per lb. fruit, as the washing equipment common in commercial use has not proved very successful. Brief notes are given on the results of previous investigations into the possibility of improving it [*R.A.E.*, A **22** 218, 651; **24** 32]. Experiments for the same purpose were carried out in central Washington, using apples that had received a calyx spray of lead arsenate and a varying number of cover sprays containing 3 lb. natural cryolite [per 100 U.S. gals.]. The substances tested were hydrochloric acid, aluminium chloride and sodium silicate. The washing machine employed was fitted with interchangeable, crosswise, underneath rollers or rotating brushes for the acid wash, crosswise, underneath rotating brushes for the alkaline wash, a positive feed mechanism allowing a period of immersion of 25 seconds, and 2 rinse tanks, in which the fruit was immersed for about 2 minutes. The fruit received a water rinse between washes in all experiments where aluminium chloride was used.

Reliable data could be obtained only by repeating the washing treatment and analysis several times, as both are subject to considerable variations. It is not possible to assign a definite value to the

fluorine residues remaining after washing, even though the spraying and washing have been carried out under experimentally controlled conditions, or to guarantee that the residue on every sample is below tolerance, even though the average is well below.

Aluminium chloride was tested as a washing solution both before and after sodium silicate, but gave poor results. The addition of 1 per cent. mineral oil caused no apparent improvement. The aluminium seemed to form a gummy deposit, which was not completely removed by a water rinse. The results of preliminary experiments, in which each sample was washed only once, were made the basis of further trials with 3 selected washing procedures, which were repeated several times. In each of these, the first tank contained 60 lb. sodium silicate per 100 U.S. gals. and the second 1·5 per cent. hydrochloric acid, at 110°F. In one case, 1 per cent. mineral oil was added to the acid, and in another, to the silicate, no oil being included in the third. Brushes were used throughout. Repetition of the experiments gave widely varying results, and the differences in relative effectiveness of the 3 treatments cannot be considered significant. Less than 50 per cent. of fruit that had received 8 cover sprays of cryolite with 0·8 per cent. emulsified mineral oil or 0·25 per cent. herring oil could be cleaned below tolerance. Fruit that had received 8 cryolite cover sprays containing $\frac{1}{4}$ lb. tar soap [per 100 U.S. gals.], 3 containing $\frac{1}{2}$ U.S. pt. herring oil (following 3 of lead arsenate), or 7 containing $\frac{1}{2}$ U.S. gal. mineral oil emulsified with $\frac{1}{4}$ lb. triethanolamine oleate, appeared easier to clean, but 10–15 per cent. of the fruit had residues over tolerance. However, it is unlikely that growers would apply 8 cover sprays of cryolite, and only one treatment (HCl with oil followed by silicate) failed to clean below tolerance the sample that had received only 3 sprays. This combination gave poor results generally. The preliminary experiments indicated that increasing the concentration of sodium silicate beyond 60 lb. per 100 U.S. gals. causes no increase in its effectiveness, mineral oil in either or both tanks is of doubtful value, brushes in the acid tank do not give consistently better results than rollers, the addition of oil to HCl may actually reduce the cleaning action, and, in the absence of oil, no advantage is shown for using the acid before, instead of after, the silicate.

Apples placed in cold storage immediately after washing were in good condition 4 months later, with the exception of those washed in solutions containing mineral oil. Washing with oil at a room temperature of 120°F. caused substantially greater loss of moisture than washing with oil at 110°F.

Hough (W. S.). **Spray Residues and their Removal from Apples.**—*Bull. Va agric. Exp. Sta.* no. 302, 20 pp., 6 figs., 1 ref. Blacksburg, Va, March 1936. [Recd. September 1936.]

During 1934–35, investigations were made in Virginia on spray residues on apples and their removal by current types of washers. The following is based on the author's summary. In the case of lead arsenate sprays, the ratio of lead to arsenic in the residue was 2 : 1, and as the tolerance in grains per lb. fruit is at present 0·018 for lead, and 0·01 for arsenic, lead residue is the limiting factor. Lead arsenate, 3 lb. to 100 U.S. gals. spray, applied in commercial orchards in the calyx and two cover sprays, the second on 11th or 12th June, resulted in an average lead residue of 0·019 and 0·013 gr. per lb. in 1934

and 1935 respectively [*cf. R.A.E.*, A **19** 631]. The maximum lead residue was 0·027 gr. Usually, however, the residue was within or sufficiently near the tolerance to permit cleaning the fruit without washing. Lead arsenate in the calyx and first cover spray, the latter being applied on 27th or 28th May, resulted in an average lead residue of 0·1 and 0·012 gr. and a maximum of 0·015 and 0·017 gr. in 1934 and 1935, respectively. The time of completing the last cover spray up to early July was more closely related to the amount of residue at picking time than the number of sprays that preceded that date. One spray of cryolite in June resulted in a maximum fluorine residue of 0·007 gr. per lb. Two cryolite sprays with 1 pint fish oil per 100 gals. as an adhesive (applied on 18th June and 20th July) caused a residue equal to the fluorine tolerance of 0·01 gr. per lb. Fluorine residue from three cryolite sprays, the last on 25th and 26th July, necessitated washing to clean the fruit to within tolerance.

For removing the residues occurring on most Virginia apples, 2–3 per cent. hydrochloric acid is adequate. For heavy residues, concentrations up to 4·5 per cent. may be required. For light residues or residues very easily removed, 1 per cent. is sufficient. The amount of fresh water required for adequate rinsing varied with the type of the washer, the strength of the acid solution and the rate of washing. Inadequate rinsing may result in acid injury wherever the acid evaporates on the fruit, or arsenical scorching at the calyx end. If sufficient water is not available for an adequate rinse, the addition of hydrated lime is advisable to neutralise the acid and convert soluble arsenic to an insoluble form. A schedule of adding lime is given for various washing operations. Heating the acid solution [**23** 558, 696] increased the efficiency of removal to a marked degree. When washing apples sprayed with lead arsenate plus oil in some of the cover sprays, brush washers removed the greatest percentage of lead and arsenic residues, while the flotation washer removed the least amount. None of the machines, when using cold acid solution, cleaned the fruit sufficiently to meet the tolerance. There was no practical difference in efficiency of residue removal by the flotation washer, flood washer, and two kinds of brush washer when washing fruit that carried residues not especially difficult to remove. Wetting agents added little or nothing to the efficiency of unheated acid solutions [*cf.* **24** 365] when the fruit remained in the acid solution for only 45–60 seconds. In heated acid solutions, the wetting agent increased the efficiency of removal. Lead arsenate was easier to remove when Bordeaux mixture had been used in the cover sprays, and more difficult when oil had been used. Hydrochloric acid was considerably more efficient than sodium silicate in removing residues of lead, arsenic and fluorine [*cf.* **23** 558; **24** 32].

Flint (W. P.) & McCauley (W. E.). **Ants—How to Combat Them.**—*Circ. Ill. agric. Exp. Sta.* no. 456, 8 pp., 2 figs. Urbana, Ill., June 1936.

An account is given of the use of baits and other measures for the control of ants in houses in Illinois. Ants differ in their food preferences, and one bait is not effective for all species. *Monomorium pharaonis*, L., is abundant in heated buildings throughout the year and makes its nests there. A small amount of poisoned bait, consisting of 2 gm. thallium sulphate dissolved in 8 fl. oz. lukewarm water and added

to a syrup of 1 lb. granulated sugar, 3 oz. strained honey, 1½ fl. oz. glycerin and 8 fl. oz. water, should be laid across the trail near the nest and renewed at least every other day. This bait and a mixture of Paris green and brown sugar (1 : 32) are both effective against the carpenter ant, *Camponotus herculeanus pennsylvanicus*, DeG., which nests in timber and the heartwood of trees, and which seldom enters houses. *Solenopsis molesta*, Say, lives out of doors, and invades houses only during warm weather. It may be controlled with a bait of tartar emetic and bacon grease or lard (1 : 9), placed in small amounts near the nest. Against *Lasius niger americanus*, Emery, and *Tapinoma sessile*, Say, both of which enter houses in search of food, particularly after heavy rain, a bait consisting of 1 lb. granulated sugar, 16 fl. oz. water, 1 gm. tartaric acid, and ½ lb. strained honey, mixed with ⅛ oz. sodium arsenite dissolved in 1 fl. oz. hot water, is effective when used near the colonies.

WATTS (J. G.). **A Survey of the Biology of the Flower Thrips *Frankliniella tritici* (Fitch) with special Reference to Cotton.**—*Bull. S. C. agric. Exp. Sta.* no. 306, 46 pp., 10 figs., 25 refs. Clemson, S.C., June 1936.

This paper is the result of investigations on *Frankliniella tritici*, Fitch, in South Carolina, begun in 1931. The following is largely taken from the author's summary : *F. tritici* is generally distributed over the larger part of the United States, except in Florida and a number of the far western States, where it is partly or entirely replaced by closely related forms. It occurs generally throughout South Carolina and causes serious damage to cotton in certain areas at irregular intervals. Of the 10 other species found on cotton, *F. fusca*, Hinds, *Thrips tabaci*, Lind., and *Sericothrips variabilis*, Beach, are of less importance, *Aelothrips bicolor*, Hinds, and *Leptothrips mali*, Fitch, have been reported to be predacious, *Anaphothrips obscurus*, Müll., *F. williamsi*, Hood, *Limothrips cerealium*, Hal., and *Echinothrips americanus*, Morgan, are not known to cause noticeable injury to cotton, and an apparently undescribed species of *Liothrips* was represented by a single individual.

Studies of the life-history of *F. tritici* [*cf. R.A.E.*, A **23** 176, 658] were made through 65 generations. There was a decided seasonal variation in the duration of the stages, but the averages in days were : egg, 3·31 ; first and second larval instars, 2·2 and 2·8 ; prepupa, 1·13 ; pupa, 2·45 ; and total development, 11·83. From 10 to 15 generations probably develop during the year, two-thirds of these from April to September. Parthenogenesis was observed, the resulting progeny being all male. Oviposition takes place on the lower surfaces of the leaves, the eggs being bedded in the tissues. A list is given of the very numerous food-plants of the thrips ; it is highly polyphagous, but seems to prefer Graminaceae, Leguminosae and Rosaceae, and to a less degree Compositae and Cruciferae. It is usually most numerous in flowers, but often severely damages the foliage of certain plants. It injures the cotton plants by feeding on the leaves, causing malformation and curling, but preferably on the terminal buds, causing a stunted condition or excessive branching [**22** 635]. Injury to cotton in South Carolina was negligible after it had reached the age of about six weeks.

Vegetation and possibly soil types have some influence on the thrips population in a given area. All stages are quite resistant to low temperatures, and heavy dashing rains are probably the most important natural control. No parasites of the thrips were found, but predators included *Orius insidiosus*, Say, *Hippodamia convergens*, Guér., and *Chrysopa* sp. No practical insecticidal control of thrips on cotton is known, but infestation and injury can be reduced by planting cotton early and as far removed from forage and cover crops as possible, promoting rapid growth of the seedlings, and practising clean culture throughout the year.

Robá (R. P.). **La hormiga de Amaga.** [*Acropyga fuhrmanni*, **For.**]—*Rev. cafetera Colombia* **6** no. 80–87 pp. 2023–2034, 13 figs. Bogotá, July 1936.

Robá (R. P.). **Un nouveau coccide signalé sur caféier.**—*Bull. Ann. Soc. ent. Belg.* **76** no. 7 pp. 297–298. Brussels, 1936.

The first of these papers deals with two ants that are associated with Coccids occurring on the roots of coffee in Colombia, *viz.*, *Acropyga* (*Rhizomyrma*) *fuhrmanni*, For., which fosters *Eumyrmococcus* sp., and *A.* (*R.*) *paramaribensis*, Borgm., which fosters *Rhizoecus coffeae*, Laing. All four insects are described. Both ants occur in shady or sunny situations, in all kinds of soil except wet soil requiring drainage, and in coffee plantations of all ages at all altitudes between those with a temperature of 24°C. [75·2°F.] and those at about 5,400 ft. Their abundance and that of the Coccids are directly related, and they feed exclusively on the secretions of the latter.

Rhizoecus coffeae has been observed on several different plants, but occurs in numbers only on coffee. From observations made, it is concluded that it cannot do serious harm to coffee, as the plants are able to replace the losses caused.

Eumyrmococcus has been found on coffee, banana, sugar-cane, maize, shade trees (*Inga spuria*, *I. edulis* and *Cassia strobilacia*) and various wild herbaceous plants. Coffee and banana are the preferred food-plants. It causes more necrosis in the coffee roots than does *R. coffeae* and, when in association with *A. fuhrmanni*, does definite injury, though if the plants are on good soil, well-shaded and carefully cultivated, they put forth new roots in compensation. Serious harm occurs, however, if conditions are unfavourable, and it is then best to put the land to other uses. If association of the ant and the Coccid is the only unfavourable factor, ground on which coffee is to be planted should be dug to a depth of 8–10 ins., and, when neither very dry nor very wet, should be watered with a 0·05 per cent. solution of potassium cyanide at the rate of about 4 gals. per sq. yard. In experiments, this gave 100 per cent. mortality of both the Coccid and the ant. The treated ground should not be planted until the cyanide has decomposed.

The second paper deals solely with *Eumyrmococcus* and its association with *A. fuhrmanni*, and the information given on it is briefer than that in the first.

Robá (R. P.). **Una plaga del sombrio : el Notodontido** *Hemiceras cadmia* **Guenée.** [A Shade-tree Pest, *H. cadmia*.]—*Rev. cafetera Colombia* **6** no. 80–87 pp. 2043–2045, 4 figs. Bogotá, July 1936.

Descriptions are given of all stages of the Notodontid, *Hemiceras cadmia*, Gn., which caused serious injury to the foliage of *Inga edulis*

grown as shade for coffee at Refugio, Colombia, in 1935. The outbreak ended naturally. It is pointed out that control would be too costly and that it is inadvisable to grow only one species of plant for shade.

JEPSON (W. F.). **Report on the Search for Parasites for *Phytalus smithi* Arr.**—66 pp., 7 maps, 44 refs. Port Louis, 1936.

An account is given of the search for parasites of Lamellicorns in Porto Rico in 1933 and the sending to Mauritius of those considered likely to be of value against *Lachnosterna* (*Phytalus*) *smithi*, Arr. [*R.A.E.*, A **22** 620]. Data obtained on the general distribution of species of *Lachnosterna* (*Phytalus*) in America are reviewed, and their Dipterous and Scoliid parasites are discussed. As numbers of these had been recorded in Porto Rico, and as the climate of that Island is very similar to that of Mauritius, it was decided to make the search there instead of in favourable continental areas where work would necessarily be more protracted. After a visit to the Japanese Beetle Laboratory in New Jersey to study methods of shipping and breeding parasites of Lamellicorns, notes on which are given, work in Porto Rico was carried out from 8th May to 7th September. Throughout the Island the numbers of *Lachnosterna* had decreased enormously since 1925 [*cf.* **22** 155]. A map shows the localities in which the different species occur. Of 1,100 adults of *L. portoricensis*, Smyth, and 2,300 of *L. citri*, Smyth, obtained by the end of the flight season in the second week of June, only 3 of the former were parasitised by *Cryptomeigenia aurifacies*, Walt. [*cf.* **23** 114], and 2 of the latter were found to contain puparia apparently of this Tachinid. The scarcity of the parasite may perhaps be accounted for by the fact that it breeds all the year round, while the hosts have two periods of abundance, in May and in September. Its population is thus periodically reduced to a very small figure, although parasitism may rise to 25 per cent. in localised areas.

The predacious larvae of *Pyrophorus luminosus*, Ill., were considered to be of value against *Lachnosterna* larvae, and were collected in large numbers for shipment to Mauritius. Some adults lived for 6 weeks in cool storage when the temperature did not exceed 65°F. The female apparently lays an average of over 200 eggs. The Island was thoroughly searched for Scoliids [*cf.* **15** 409–411] and the species found were *Elis ephippium*, F. (*xanthonotus*, Rohw.), *E. haemorrhoidalis*, F., *Campsomeris trifasciata*, F., *C. dorsata*, F., and *C. tricincta*, F., (*pyrura*, Rohw.). Members of this family appear to limit their attack to larvae of a certain size, parasitising the second or third instars accordingly. Methods of collecting and packing are described in detail. The following were taken to Mauritius: *E. ephippium*, 700 females, none survived; *C. trifasciata*, 51 females, none survived; *C. dorsata*, 31 females, 18 survived; *Pyrophorus luminosus*, 490 larvae, 320 survived; *Elis* cocoons, 102, 12 survived. A consignment of *Bufo marinus* was also taken, but the toads were destroyed on arrival [**22** 621].

An appendix comprises notes on the bionomics of the five Scoliids found. Of these *C. dorsata* is primarily a parasite of Dynastids, attacking *Ligyrus tumulosus*, Burm., but occasionally attacks *Lachnosterna portoricensis* and *L. vandinei*, Smyth, while the others are normally parasites of various species of *Lachnosterna*. Another appendix deals with information received concerning the shipment of Scoliids to Barbados for use against *L. smithi* there [**22** 699]. At the end of the report are three tables, of which the first shows the species of

Lachnosterna in the American National Museum and the British Museum of Natural History, with the localities in which they were collected, the second comprises a catalogue of Scoliids and their hosts, and the third gives the salient characters by which genera of economic Scoliids may be distinguished.

GOMEZ MENOR [Y] O[RTEGA] (J.). **Idea sobre los Bupréstidos y especialmente sobre un enemigo del Pino.** [A Note on Buprestids and especially on a Pest of Pines.]—*Rev. agric. Com.* **27** no. 81 pp. 2463–2465, 2 figs. Ciudad Trujillo, June 1936.

Buprestis lineata, F., is recorded as boring into the trunks of pines in Santo Domingo. It may be destroyed by injecting carbon bisulphide into the holes or by placing in them plugs of cotton-wool soaked in creosote.

DE LARA (R.). **Cómo se combate con exito el temibile catarrón del coco.** [A successful Measure against *Strategus titanus* in Coconut.] —*Rev. agric. Com.* **27** no. 81 p. 2470. Ciudad Trujillo, June 1936.

Strategus titanus, F., sometimes kills young coconut palms in Santo Domingo by boring into the stems. A plug of cotton-wool soaked in carbon bisulphide should be pushed into the hole with a wire.

NEWMAN (L. J.). **Thrips Census.**—*J. roy. Soc. W. Aust.* **21** pp. 93–97. Perth, 1935. **New Species of Thrips from south-western Australia.** —*T.c.* pp. 97–100. [Recd. September 1936].

In the first paper, a list is given of 43 species of Thysanoptera, including the new ones described in the second paper, collected in February–November 1932, from wild, garden and orchard flowers in the fruit-growing areas of south-western Australia. The dominant and most destructive species was *Thrips imaginis*, Bagn., which breeds in the flowers of indigenous and introduced *Acacia* and in those of some 15 other indigenous plants and of many garden plants and fruit trees. Other species of importance were *T. tabaci*, Lind., on garden flowers and vegetables, *Isoneurothrips australis*, Bagn., chiefly on *Eucalyptus*, *Odontothripiella* (*Odontothrips*) *australis*, Bagn., chiefly on *Acacia* and other native leguminous plants, and *Frankliniella insularis*, Frankl., on garden flowers, tomatos, etc. The new species described in the second paper are *Lamprothrips* (gen. n.) *maculosus*, *Rhipidothrips aureus*, and *Phaulothrips fuscus* from *Eucalyptus* spp., *Anaphothrips varii* from clover. *A. newmani* from *Acacia*, and *Liothrips atratus*, taken by sweeping.

EDWARDS (E. T.). **The Witches' Broom Disease of Lucerne.**—*Sci. Bull. Dep. Agric. N.S.W.* no. 52, 31 pp., 15 figs., 8 refs. Sydney, April 1936.

An account is given of witches' broom disease of lucerne, which occurs in New South Wales, Queensland, Victoria and South Australia, and of investigations carried out on it since 1931 in New South Wales, which showed that it is caused by a virus and is transmissible by grafting. In the course of the work, a number of insect transmission experiments were carried out. In preliminary experiments in which

Jassids and thrips of undetermined species prevalent on lucerne in the field were used as possible vectors, 16 healthy plants were treated, but without result. Subsequent experiments, in which mass populations of insects occurring on lucerne, of which 80 per cent. were Thysanoptera and Rhynchota, were enclosed on a number of occasions with diseased and healthy plants, also failed to produce the disease except on one plant out of 120 in transmission cages. Some evidence supporting the theory of insect transmission was received from plants established in October 1932 for inoculation experiments. They comprised 120 plants maintained in insect-proof frames from date of planting, and 113 plants in open rows, both series including inoculated and control plants. Up to the removal of the frames in September 1934, none of the plants showed any evidence of infection. Subsequent examination in February 1935 showed that 2 out of 53 control plants and 3 out of 70 inoculated plants grown in open rows had definite symptoms of the disease, whereas there was no evidence on any of the plants that had been grown under cover.

Ward (K. M.). **Apple Leaf-hoppers. An Outbreak in Victorian Orchards.**—*J. Dep. Agric. Vict.* **34** pt. 7 pp. 328–330, 376, 5 figs., 2 refs. Melbourne, July 1936.

A severe outbreak of the apple leafhopper, *Typhlocyba froggatti*, Baker (*australis*, Frogg.) [*cf. R.A.E.* A **22** 656], occurred for the first time in Victoria in the season 1935–36. There appear to have been three generations during the season, activity continuing until late April. The nymphs that hatched from the overwintered eggs matured in about a month. The adults flew readily, but rarely went beyond one tree, thus spreading slowly through the orchard. The summer eggs are deposited within the tissue of the leaf, notably in the midrib and main veins, and the overwintering eggs in the bark layers of the young wood, where they cause minute swellings. No example of this Jassid was observed on fruit trees other than apple or on weeds. Injury is caused by feeding on the lower surface of the leaves, which causes the appearance of whitish patches and may eventually result in partial defoliation, and by the excrement deposited on the fruit. If the fruit becomes wet through rain or spray, brown marks, difficult to erase, appear on it.

In spraying tests made in February, nicotine sulphate (1 : 640) was used in combination with oil (1 per cent.), soap (2 lb. to 80 gals.) or lead arsenate (5 lb. to 80 gals.). It gave 99·5 per cent. control of the nymphs with oil, 97 per cent. with soap, and 95 per cent. with lead arsenate, and also killed high percentages of the adults. The author suggests that nicotine sulphate against *T. froggatti* might be combined with the lead arsenate sprays used against the codling moth [*Cydia pomonella*, L.] ; an admixture of white oil would render the spray more effective against the former. White oil by itself gave a poor control, and 70 per cent. of adults recovered after 6 hours.

Eguchi (M.). **On simple Methods of fumigating** *Gelechia gossypiella* **Saund.** [*In Japanese.*]—*Chosen Nokai Ho* **10** no. 3 reprint 8 pp. Keijo, Korea, March 1936.

Platyedra (*Gelechia*) *gossypiella*, Saund., is very injurious to cotton in Korea, and infestation by it has been found to be more severe in

fields near cotton warehouses than in those at a distance from them. The larvae generally leave the bolls when they are dried in the sun. Large numbers can be destroyed by fumigating the harvested bolls for 24 hours with carbon bisulphide or chloropicrin at the rate of 4 or 1·5 lb., respectively, per 1,000 cu. ft. Such fumigation does not affect the germination of the seeds.

TSUDA (S.). **Studies on the Worm-eaten Seeds of Soy Bean.** [*In Japanese.*]—*S. Manchuria Rly agric. Exp. Sta. Res. Bull.* no. 16 pp. 1–47. Koshurei, Manchuria, May 1936.

Of the 28 species of insects known to attack soy beans in Manchuria, *Cydia* (*Grapholitha*) *glycinivorella*, Mats., is the most important. It causes more damage in the south of Manchuria than in the north.

In 1934, over 13 per cent. of the beans were infested. Infestation is most severe on varieties of soy bean that flower before the end of July and those that are hairy. It is increased by dense planting. The extent of the injury is not dependent upon the fat content of the seed. The larger seeds are more damaged, and two seeds in each pod are usually attacked.

KOBAYASHI (K.). **Studies on the Chemotropism of** *Dysdercus megalopygus* **Breddin.** [*In Japanese.*]—*Oyo-Dobuts. Zasshi* **8** no. 4 pp. 177–196. Tokyo, September 1936.

In Formosa, *Dysdercus cingulatus*, F. (*megalopygus*, Bredd.) attacks cotton, *Hibiscus* and various wild malvaceous plants. Near Taihoku, it begins to migrate to cotton in mid-July. In experiments, the adults of both sexes were attracted to the flowers, leaves and fruits of cotton and other malvaceous plants and to dew on the cotton leaves. The fruits or bolls, which are the parts of the plant most injured in nature, were least attractive in the experiments. The bugs were also attracted by very dilute solutions of ammonium hydroxide, particularly at concentrations of from 10^{-7} to 10^{-5} per cent., and to a slightly less extent by trimethylamine at concentrations of from 10^{-7} to 10^{-4} per cent.

TSUCHIYAMA (T.). **On the Poisoning Death caused by Feeding on** *Ricinus communis* **(Castor) in** *Serica orientalis* **Motsch.** [*In Japanese.*]—*Oyo-Dobuts. Zasshi* **8** no. 4 pp. 202–207. Tokyo, September 1936.

In some parts of Manchuria, castor (*Ricinus communis*) is cultivated with other plants in order to prevent injury to the latter by insects. The adults of *Aserica* (*Serica*) *orientalis*, Motsch., are generally poisoned if they feed on the castor leaves. Those fed on them for 24 minutes in the laboratory became paralysed and died in periods averaging 56 minutes and 157 hours, respectively. Outdoors, 94 per cent. died in 4 days. The percentages that recovered from the paralysis were 6 outdoors and 35 in the laboratory. In southern Manchuria, the beetles emerge from late April to late June, and cause serious damage to cotton, tobacco, maize, etc.

YAMADA (Y.). **An Account of the Control of injurious Insects in the Treasure House of Daigo Temple, Kyoto.** [*In Japanese.*]—*Oyo-Dobuts. Zasshi* **8** no. 4 pp. 222–223. Tokyo, September 1936.

An instance is recorded of *Lyctus brunneus*, Steph., infesting wooden articles and boring into copper plates. It was controlled by pouring carbon bisulphide into its mines.

KAMIYA (K.). **The Relation of Hymenopterous Parasites of *Dendrolimus spectabilis* Butl. to other Hosts.** [*In Japanese.*]—*Oyo-Dobuts. Zasshi* **8** no. 4 pp. 224–227. Tokyo, September 1936.

Though the larval stage of *Dendrolimus spectabilis*, Btlr., lasts about 300 days in Japan and the pupal stage only about 20 days, there are 12 species of Hymenopterous parasites that attack the pupae and only 5 that attack the larvae. Most of these parasites also attack other moths [*cf. R.A.E.*, A **23** 131] ; lists are given of them and their hosts. Of the egg-parasites of *D. spectabilis*, *Trichogramma dendrolimusi*, Mats., also breeds in the eggs of *D. albolineatus*, Mats., and *Anastatus albitarsis*, Ashm., in those of *Dictyoploca japonica*, Moore.

KOJIMA (T.). **Observations on the Hymenopterous Parasites of *Dendrolimus spectabilis* Butl.** [*In Japanese.*]—*Oyo-Dobuts. Zasshi* **8** no. 4 pp. 233–234. Tokyo, September 1936.

On an average, 22·8 individuals of *Trichogramma dendrolimusi*, Mats., were found in a parasitised egg of *Dendrolimus spectabilis*, Btlr., and 28·2 in one of *Dictyoploca japonica*, Moore [*cf.* preceding paper]. In experiments, this parasite did not attack eggs of *Malacosoma neustria testacea*, Motsch., *Ivela auripes*, Btlr., or *Bombyx mori*, L. Only one individual of *Anastatus albitarsis*, Ashm., was found in each egg of *D. spectabilis*. The prepupae of *Dicamptus nigripictus*, Mats., overwinter in the cocoons of *D. spectabilis*, and pupate in April, the adults emerging in mid-June. Over 50 per cent. of this Ichneumonid are themselves parasitised by *Monodontomerus spectabilis*, Mats., about 60 individuals of which emerge from a host, the females far outnumbering the males.

TABE (C.). **On *Contarinia* sp., a new Pest of Apple. 2.** [*In Japanese.*] —*J. Plant Prot.* **23** no. 8 pp. 596–604. Tokyo, August 1936.

Further details are given of the bionomics of the species of *Contarinia* that attacks apple in the Nagano Prefecture [*R.A.E.*, A **24** 631]. The eggs hatch in 12–15 days, when the apple trees begin to blossom, and about 45 larvae, which mature in 15 days, are found in each flower bud. The infested buds do not open, the petals become thick and spotted with a darker pink, and the whole bud is enlarged. The larvae leave the buds in the early morning and enter the soil, where they are found within an inch of the surface. The prepupal stage lasts for about 140 days, pupation occurring in late September, and the pupal stage lasts for about 190 days. Infestation is confined to a small area, and the larvae are attacked by a Hymenopterous parasite. Infested buds should be picked off before the larvae leave them.

Amano (E.). **On a Fly boring into the Stalks of Italian Millet.** [*In Japanese.*]—*J. Plant Prot.* **23** no. 9 pp. 686–691, 1 pl. Tokyo, September 1936.

In the Tochigi Prefecture, Japan, from 5 to 50 per cent. of the stalks of young millet [*Setaria italica*] are infested by the larvae of an undetermined fly, which also attacks *S. viridis* and *S. glauca*. One larva is found in each stalk. The full-grown larvae hibernate in the soil, and pupate in May. Adults emerge at the end of May, in mid-June and in August.

Asano (I.). **Comparison of the Injuries of Sawflies on cultivated and wild Roses.** [*In Japanese.*]—*J. Plant Prot.* **23** no. 9 pp. 691–694. Tokyo, September 1936.

The sawflies attacking roses in Japan are *Cladius pectinicornis*, Geoffr., *Arge pagana*, Panz., and *A. nipponensis*, Rohw.

Asano (I.). **Does *Arge pagana* Panzer injure Rhododendron?** [*In Japanese.*]—*Insect World* **40** no. 7 pp. 279–281. Gifu, Japan, July 1936.

Arge pagana, Panz., which causes considerable injury to rose in Japan, was not found to attack *Rhododendron*, though it has been stated to do so in the literature.

Hirose (K.). **Insect Pests of Insect Specimens and Control Methods. 2.** [*In Japanese.*]—*Insect World* **40** no. 7 pp. 281–283. Gifu, Japan, July 1936.

The pests dealt with in these notes, which belong to a series [*cf. R.A.E.*, A **24** 701], include *Megatoma varia*, Mats. and Vokoy., *Aglossa dimidiata*, Haw., *Ptinus fur*, L., and *Trogium* (*Atropos*) *pulsatorium*, L.

Atkinson (D. J.). **Some Experiments on the Control of the Bamboo Shot-hole Borer *Dinoderus* spp. in Bamboo Dunnage (Bostrychidae-Coleoptera).**—*Burma For. Bull.* no. 32 (Ent. Ser. no. 3) 14 pp. Rangoon, 1936.

Further details are given of the superficial damage to teak exported from Burma in 1932 that was caused by the Bostrychid, *Dinoderus ocellaris*, Steph. (*pilifrons*, Lesne), coming from bamboo dunnage [*R.A.E.*, A **22** 123], and of experiments already briefly noticed [**23** 210] to test the theory that bamboos soaked in water were immune from the attacks of the Bostrychid, and to ascertain the starch-sugar content of such bamboos. The results are considered somewhat inconclusive, owing to errors in technique. In the past, bamboo dunnage was transported by water, but is now brought to Rangoon by rail. Water-borne bamboo was generally free from *Dinoderus*. Comparative analyses of the starch-sugar content of soaked and unsoaked bamboos showed that the sugars were reduced from a maximum of 3·41 per cent. for one-year-old and 6·61 per cent. for older bamboos to a mere trace by soaking for 6 weeks, while the percentage of starch increased.

It had also been reported that this Bostrychid was found in bamboo matting used as dunnage, but the beetle in question was probably *Tribolium castaneum*, Hbst., which was observed in numbers in such matting in ships in Rangoon. It is not certain, however, that *D. ocellaris* was the only Bostrychid concerned in the damage to teak, as two other species of the same genus were more numerous in bamboo dunnage in Burma [**24** 241].

[Telenga (N. A.).] **Теленга (Н. А.). *Aphelinus mali* Hald. and its Application against *Eriosoma lanigerum* in USSR.** [*In Russian.*]—*Bull. Plant Prot.* (1, Ent.) no. 16, 58 pp., 10 figs., 1 graph, 49 refs. Leningrad, 1935. (With a Summary in English.) [Recd. 1936.]

This is a survey, largely based on the literature, of the bionomics of *Aphelinus mali*, Hald., and its utilisation against *Eriosoma lanigerum*, Hsm., on apple in the Russian Union and elsewhere. In the Russian Union, it is at present established over more than 150 square miles, having been successfully introduced into the Crimea [*R.A.E.*, A **21** 633], North Caucasus [**23** 576], all parts of Transcaucasia [*cf.* **24** 674], Uzbekistan [**24** 311], and south-western Ukraine. It is also common in orchards near the river Dniester in Moldavia, although it was not introduced there ; it may possibly have migrated from Rumania, where it was introduced in 1923. In Azerbaijan, where it was introduced in 1926, it was found to have migrated during a period of 8 years to a distance of about 125 miles from the place of liberation, and now occurs in a number of districts. A fungus that attacked the larvae and pupae in North Caucasus in 1932, causing them to dry up [*cf.* **23** 576], was found to be *Monilia candida*.

Cameron (A. E.). *Adelges cooleyi* **Gillette (Hemiptera, Adelgidae) of the Douglas Fir in Britain : Completion of its Life Cycle.** *Ann. appl. Biol.* **23** no. 3 pp. 585–605, 1 pl., 3 figs., 5 refs. Cambridge, August 1936.

Chermes (*Adelges*) *cooleyi*, Gill., has been observed in Britain on *Pseudotsuga taxifolia* (*douglasi*), the secondary food-plant, since 1913. Hitherto its life-cycle in Britain has been regarded as incomplete, because of the supposed sterility of the sexuales (generation V) on Sitka spruce (*Picea sitchensis*), which is the primary food-plant, and the consequent absence of the fundatrix vera (generation I) and gallicolae (generation II) [*cf. R.A.E.*, A **10** 605]. During 1935, however, both these generations were found in Scotland and their development followed.

Dead galls of *C. cooleyi* were found on Sitka spruce in south-east and central Scotland in the spring and summer, and during April second- and third-instar nymphs of the fundatrix vera (progeny of the sexuales) were found, and some were transferred to the laboratory. The first of these began to oviposit on 16th April, and each laid 300–500 eggs, which started to hatch 10 days later. In the field, hatching was not observed until May. A severe frost on 16th–17th May destroyed 75 per cent. of the buds together with many of the unhatched egg-masses and first-instar gallicolae where these had hatched, thus reducing the material for field observations. The fundatrices verae are not confined to the bases of the buds, but may occur on the twigs at some distance from the terminal buds. In these cases it is unlikely that the fundatrix

can affect the process of gall-forming, and observations have shown that the only buds galled are those that become infested with first-stage gallicolae ; if the galled bud is one of a terminal group, the remaining uninfested ones develop normally. A marked negative geotropism was responsible for a tendency in the nymphs to select the apical bud. Twigs were transferred to the laboratory in April and May and were maintained in water until the process of gall-formation had been observed. Field observations were also made. A description is given of the shape and colour of the galls. In the field, the winged gallicolae (generation II) matured in early September, and were observed migrating to Douglas fir, where they settled and oviposited. In the laboratory they migrated in the second half of August and laid 100–150 eggs each. A young Sitka spruce placed in the cage was entirely neglected by the winged migrants, but when it was infested by hand a small percentage of them settled and oviposited. The resulting nymphs resembled in all respects those that hatched on Douglas fir. Many of them dropped from the needles, as they were unable to penetrate the leaf tissue with their stylets, but a few still remained on 20th December.

The colonici on Douglas fir (generation III) were found to be triple-brooded, comprising a winter brood and two consecutive summer broods, in contrast to the two broods in the south of England [*loc. cit.*]. The population of the sistentes on Douglas fir during any one winter was found to be composed of 4 categories : the whole of the first winter brood, that is, the whole of the progeny of the gallicolae migrantes ; part of the progeny of the first winter brood of the previous year, apparently the part arising from eggs laid by late-maturing colonici ; part of the progeny of the first summer brood ; and the whole of the progeny of the second summer brood. In the county of Peebles, the migration of the sexuparae (generation IV) to Sitka spruce was observed in the field on 26th June. It had probably been in progress for about a week, and it continued until the third week in July. This was confirmed in the laboratory, where each sexupara laid 10–12 eggs and oviposition was completed by 25th June. The eggs hatched in 7–10 days in the laboratory, and 10–12 days in the field. Sexuparae have also been found in Scotland on *Picea glauca* (*alba*), *P. mariana* (*nigra*) and *P. pungens*, and dead galls on *P. glauca*. Norway spruce [*P. abies*] planted with Sitka spruce in Peebles was entirely neglected by sexuparae. The first-instar nymphs of the sexuales (generation V) were inactive, and generally remained where they hatched in groups of 7–12. They inserted their mouth-parts into the leaf tissue but did little feeding. The first ecdysis took place, but second and later instars were extremely rare. Only a few adults were obtained, and these were mostly males. Oviposition was not observed, nor was a single egg recovered, although the existence of the fundatrices verae show that a few must occur. There is no apparent reason for this enormous mortality at the time of the first moult. The evidence appears to indicate the existence of an inherent constitutional weakness of the sexuales, which may be accentuated by unfavourable climatic conditions and maladaptation to the primary food-plant.

A. D. Heriot stated in correspondence that in British Columbia the colonici of *C. cooleyi* on Douglas fir are triple-brooded, as in Scotland, and that individual sexuparae lay eggs on spruce giving rise to either males or females but never to both. The resulting female develops a single egg, but this has not been found on the tree.

JARY (S. G.). **Further Experiments on the Control of the Hop Red Spider Mite,** *Tetranychus telarius* **L.**—*Ann. appl. Biol.* **23** no. 3 pp. 606–611, 4 refs. Cambridge, August 1936.

An account is given of experiments carried out in Kent in 1935 on the toxicity of sprays (some of which had given inconclusive results in previous tests [*R.A.E.*, A **24** 60]) to *Tetranychus telarius*, L., on hops. The following is almost entirely taken from the author's summary: In small-scale experiments, the sprays were applied twice, on 23rd–24th July and 1st–2nd August, respectively, to hops in pots. Lime-sulphur at a concentration of 1 : 80 proved very toxic to the mites, but a second application had to be made to deal with those that hatched subsequently from eggs. Emulsions of a "water white" petroleum oil at 2 and 1 per cent. concentrations were very toxic to the mites, but caused marked oedema in the plants. Whale oil-potash soap at 1 and ½ per cent. concentration, cotton-seed oil emulsion (6 pints of oil per 100 gallons of wash), derris extracts of 0·005 and 0·002 per cent. rotenone content, and a pyrethrum extract of 0·0025 per cent. content of pyrethrins 1 and 2, were all without appreciable toxic effect upon the mites. Lime-sulphur, 1 : 80, to which a wetter of the sulphonated lorol type was added, proved successful in the field for the control of *T. telarius* on hops when applied on 18th July. No injury to the plants resulted, though they also received two sprays of Bordeaux mixture, the first 4 days before, and the second 4 days after the lime-sulphur.

COHEN (M.). **The Biology of the Chrysanthemum Leaf-miner,** *Phytomyza atricornis* **Mg. (Diptera : Agromyzidae).**—*Ann. appl. Biol.* **23** no. 3 pp. 612–632, 2 pls., 9 figs., 17 refs. Cambridge, August 1936.

The following is the author's summary of the results of a detailed investigation of *Phytomyza atricornis*, Mg., infesting chrysanthemum in England [*cf. R.A.E.*, A **24** 512]: The synonymy and distribution of the chrysanthemum leaf-miner are discussed. The host plants are enumerated, and it is shown that the attacks on chrysanthemums decrease by August, although the flies are still common on other Compositae. A description and comparison of the morphology of the three larval instars is given, and the method of feeding of the larva is discussed. The puparium and emergence of the adult fly are also described, together with an attempt to separate the puparia into sexes by measurement. Some degree of natural control is secured by the parasitism of a Braconid on which a Chalcid is probably hyperparasitic. A table is included comparing the developmental period of *P. atricornis* and *P. chrysanthemi*, Kowartz.

THOMAS (I.). **On the Occurrence in England of the Pear Fruit Saw-fly,** *Hoplocampa brevis* **Klug.**—*Ann. appl. Biol.* **23** no. 3 pp. 633–639, 1 pl., 3 figs., 8 refs. Cambridge, August 1936.

In 1935, *Hoplocampa brevis*, Klug, was taken, for the first time in England, on pear trees in two gardens in Cambridge, in one of which slight infestation had apparently occurred in the previous year. A few females were found on pear blossom in April, but no males were observed, and it is possible that the species is parthenogenetic. Three females were enclosed with pear flowers and one oviposited on 25th

April. The eggs were laid singly in the receptacle of the flower, and probably hatch in a few days, since larvae, thought to be in the second instar, were found in pears on 11th May. On hatching, the larva appears to bore directly into the young fruit, which is eaten out. A blackening is visible, and a minute hole from which frass is exuded. The larvae probably pass through 5 instars, the first of which was not observed. By 6th June most of the larvae were fully fed and had dropped to the ground. On 23rd July, 13 cocoons were recovered from the soil beneath a pear tree at depths of 2–8 ins. Cocoons examined on 11th January 1936 still contained viable larvae, so that the species probably overwinters as a larva. All stages are briefly described, and a table is given showing the average widths of the head capsules of the larval instars of *H. brevis*, *H. testudinea*, Klug, and *H. flava*, L.

PETHERBRIDGE (F. R.) & THOMAS (I.). **Damage to Wheat by** *Helophorus nubilus* **F.**—*Ann. appl. Biol.* **23** no. 3 pp. 640–648, 1 pl., 3 figs., 4 refs. Cambridge, August 1936.

Early in 1934, *Helophorus nubilus*, F., the larva and pupa of which are described, was a serious pest of wheat in the coastal regions of the east of England between the Thames estuary and the Wash. No previous record of severe infestation has been made, but slight damage was observed in January 1922 and January 1923. Injury may be found below the first node (where occasionally the stem is completely severed), above the first node (where the central shoot is frequently eaten through), between the first node and the base of the highest expanded leaf blade, and just above the base of the highest expanded leaf blade (where the leaf of the central shoot may be completely severed). Observations in widely separated fields show that the intensity of attack varies with the cropping, and is most serious after rye grass and clover, and when the tilth is loose. In 1934, wheat following sainfoin was badly attacked in one place, and although damage to wheat following wheat was also severe, it was less so with early ploughing and drilling. Injury was less severe in 1935, and generally occurred in association with infestation by the frit-fly [*Oscinella frit*, L.] after rye grass and clover ley. The damage is caused by the larvae in the winter ; in 1934, little occurred after mid-April. The larvae usually feed on individual plants without necessarily killing them, and neglect neighbouring ones, so that the area attacked contains a mixture of green and yellow leaves. In many of the fields examined the tilth was very loose, and at the time of the attack each plant consisted of one shoot and primary roots, so that they were easily killed if eaten through below the first node. Occasionally parts of a field had a firmer tilth, and here the plants tillered and sent out secondary roots, and many recovered from the damage. Eggs were not found, but the earliest attack took place in January. Larvae kept on wheat in pots began to pupate in early April, and by 26th May 10 adults were present. In the field no adults were found until the 27th July, when one was taken on the grass bordering a hedge. These observations suggest that there is only one generation a year and that the adults live from May till October. The species overwinters in the larval stage, but possibly a few of the beetles live through the winter.

Petherbridge (F. R.) & Thomas (I.). **The Common Rustic Moth, *Apamea* (*Hadena*) *secalis* L., attacking Winter Cereals.**—*Ann. appl. Biol.* **23** no. 3 pp. 649–652, 7 refs. Cambridge, August 1936.

From 1918 to 1921, *Trachea* (*Apamea*) *secalis*, L., the larva of which is briefly described, was reported to have injured rye, oats and wheat in different districts of England, by feeding internally in the stems. In February 1934, a field of wheat of loose tilth and on light sandy soil adjacent to grassy spaces was so severely damaged that only about 10 per cent. of the wheat plants remained. Some of the injury was due to *Helophorus nubilus*, F. [see previous paper] and to frit-fly [*Oscinella frit*, L.], but most of it was caused by *T. secalis*. This field, which followed red clover and rye grass, was later ploughed up and resown with barley, which showed no damage from *T. secalis* when examined on 16th April. Winter barley in a neighbouring field had been less severely attacked. Injury was also reported from other widely separated fields. The larvae generally fed at the base of the central shoot, which was sometimes eaten away ; in later stages the sheathing leaves were also consumed and the whole plant destroyed. In the laboratory the larvae fed voraciously when caged with young wheat plants, which were eventually eaten through about $\frac{3}{4}$ in. above the ground level. Four larvae caged on 20th March ate off 14 wheat stems in a week. Moths were bred out early in July, and were taken at light in the field on 22nd July. It seems probable that eggs are laid on the grasses before ploughing, and that the larvae feed on them before attacking the wheat.

Barnes (H. F.) & Mercer (S. P.). **Damage to Panicles of *Alopecurus pratensis* L. by *Apamea secalis* L.**—*Ann. appl. Biol.* **23** no. 3 pp. 653–657, 1 pl., 1 fig., 3 refs. Cambridge, August 1936.

Brief descriptions are given of the adult and larva of *Trachea* (*Apamea*) *secalis*, L., which is widely distributed in the British Isles, and occurs eastwards to western China and Japan. It has one generation a year, and the adults are in flight from July to September. The larvae, which feed in the stems of many grasses (especially *Festuca*, *Dactylis* and *Poa annua*) and also cereals [*cf.* preceding paper], are found from September until the following April or May, when they pupate in the soil. An unusual type of damage is caused during April and May by larval feeding on the florets of grasses within the sheath. When the flower-head bursts from its sheath, the larva makes its way downwards to the uppermost node where it eats through the soft basal portion of the culm and emerges by piercing the sheath at a point immediately above the node. This type of damage, which is most common on *Alopecurus pratensis*, has been observed since 1922 in Northern Ireland, and during 1935 in Hertfordshire.

Jones (D. P.). **Gall Midges affecting Grass Seed Production in Mid-Wales.**—*Welsh J. Agric.* **12** pp. 192–197. Cardiff, 1936.

Evans (G.) & Jones (D. P.). **The Control of Gall Midges affecting Seed Production in Grasses.**—*T.c.* pp. 198–204, 8 refs.

In the first paper, a list is given of the Cecidomyiids that affect grass seed production in central Wales, and their biology is briefly discussed [*cf. R.A.E.*, A **18** 501]. *Alopecurus pratensis* was attacked by *Contarinia merceri*, Barnes, which has a wide distribution. In 1935,

the adults were present throughout June, and the larvae occurred on grass heads until the latter half of July, causing 50 per cent. infestation on several old seed plots. *Dasyneura alopecuri*, Reut., and *Stenodiplosis geniculati*, Reut., caused infestations of 5 and 12–15 per cent., respectively, on the same grass ; their larvae pupate in the seed coats, while those of *G. merceri* migrate to the soil before pupation. *Arrhenatherum avenaceum* suffered 10–25 per cent. infestation by *C. arrhenateri*, Kieff., but this grass is of little agricultural importance. *Dactylis glomerata* was infested by *Contarinia dactylidis*, Lw., and *Dasyneura dactylidis*, Met. ; the latter appeared to exist at slightly higher altitudes than the former. Combined infestation is not as a rule very high, but it rose in one area to 36 per cent. *Festuca rubra* and *Holcus lanatus* were both infested by unidentified species of *Contarinia*, and *Lolium perenne* (perennial rye grass) by *C. lolii*, Met. The larvae of this last species caused a 5 per cent. infestation in one area in 1935, attaining their maximum abundance about 20th–25th June. Predatory larvae of *Lestodiplosis* and *Arthrocnodax* were found on some of the grasses. The midges were more abundant both in numbers and species in Montgomeryshire than in Cardiganshire ; this was probably due to weather conditions.

In the introduction to the second paper, the importance of the damage caused by these gall-midges is briefly discussed. *D. alopecuri* was introduced into New Zealand about 26 years ago, and soon prevented the commercial production of seed of *Alopecurus pratensis*. At least two species now occur on the same grass in Canada [**23** 640]. It has not been definitely established that all the midges occurring on different grasses are in reality specifically distinct, a question of importance in connection with the possibility of spread of infestation from one grass to another. Population fluctuations are thought to be due to weather conditions [**24** 56–59, 554]. Wind velocity and precipitation are considered to have an important effect in limiting numbers and distribution, as the females ascend to the flower heads to oviposit only during still weather and in the absence of rain.

Seed treatments found effective in Denmark against *D. alopecuri* and *S. geniculati* consist of heating the seed to a temperature of 59–60°C. [138·2–140°F.] for 35 minutes, or treating it with carbon bisulphide (1 oz. per cu. ft.), so far as possible in a sealed room. In the field, the isolation of plots of grass grown for seed by at least 400 yards provides a measure of protection against midge migration from affected crops. Pasture types of rye grass may be sown with wild white clover and seed crops of the grass and clover taken in alternate years. When clover is to be taken, the sward should be grazed close till mid-June, suppressing the rye grass inflorescences so that the midges cannot breed. In years when the rye grass is taken, the insect pests of clover may be reduced by harvesting in mid-July and the close grazing of the aftermath. With other grasses the wide drill system is recommended for seed production. Thorough inter-drill cultivation should be carried out periodically throughout spring, summer and autumn. If the midge population begins to increase seriously, the grass rows should be grazed close in the following year or several cuts of short grass should be taken for artificial drying in preference to taking a crop of hay. Hay should be harvested in June, and the aftermath of short leys should be grazed bare in preference to taking a second crop. The cutting back of grasses in the spring to delay flowering until the peak of oviposition by the midges is past may cause considerable reduction in infestation, but

decreases the amount of seed produced [*cf.* **18** 502]. Land for the production of grass seed should not be low lying and sheltered. Districts consisting chiefly of large ploughed areas and where susceptible grasses are more or less absent from neighbouring pastures and from old leys should be used. Should the midges be proved to be specific to the various grasses, the planting of these in rotation should be an effective method of control.

TRAPPMANN (W.) & HILGENDORFF (C.). **Grundsätzliches zur Frage der Obstbaumkarbolineen und Baumspritzmittel.** [Basic Principles regarding Fruit-tree Carbolineums and Baumspritzmittel.]— *NachrBl. dtsch. PflSchDienst* **16** no. 8 pp. 73–74. Berlin, August 1936.

In 1930, standards were established in Germany [*R.A.E.*, A **18** 183] for the water-soluble fruit-tree carbolineums used as winter sprays. They consist chiefly of coal tar oil, frequently mixed with oil from brown coal, with the addition of soap and other substances, and are emulsified with water. The standards did not specify the emulsifiers and allowed considerable latitude as regards the tar oils used.

For many years tar oils with components boiling under 270°C. (medium oils) were used for fruit-tree carbolineums, but latterly tar oil sprays have been marketed with a larger content of oils boiling above 270°C. (heavy oils). Some of these new preparations are sold at the same prices as the usual kinds, and some are sold at higher prices and labelled " concentrated " or " double strength," which terms are based on the fact that a working strength of 5 per cent. is prescribed instead of the customary 8–10 per cent. The accuracy of such terms has been disputed. The desire to combine carbolineum winter sprays with the first spray against *Fusicladium* has led to the preparation of tar oil sprays that are emulsified without soap and can therefore be combined with Bordeaux mixture. These new carbolineums, which are generally known as Baumspritzmittel [*cf.* **23** 705], do not satisfy the standard requirement of not disintegrating when allowed to stand for 72 hours. In view of the above difficulties systematic experiments have been in progress since 1934 with all three kinds of carbolineums and the results to date are noticed in the two following abstracts.

It is suggested that these tar distillates should be differentiated as medium oil fruit-tree carbolineum, heavy oil fruit-tree carbolineum, medium oil Baumspritzmittel and heavy oil Baumspritzmittel, the last two being thus distinguished from arsenicals and fungicides, which are also Baumspritzmittel (tree sprays).

TOMASZEWSKI (W.) & FISCHER (W.). **Versuche mit Obstbaumkarbolineen and Baumspritzmitteln.** [Experiments with Fruit-tree Carbolineums and Baumspritzmittel.] — *NachrBl. dtsch. PflSchDienst* **16** nos. 8–9 pp. 74–76, 87–89, 1 diagr., 7 refs. Berlin, August–September 1936.

Details are given of experiments in 1934–36 to test the dependence of the insecticide action of tar oil sprays on their physico-chemical constitution. The tests were made with commercial products and special preparations on eggs of *Bombyx mori*, L., *Cheimatobia brumata*, L., and *Psylla mali*, Schm., and on adults of *Anthonomus pomorum*, L. It was found that a higher content of oils boiling above 270°C. increased the

reliability of ovicide action. The partial substitution of oils from brown coal for those from hard coal should not, on the whole, prove disadvantageous to the efficiency of the preparations. An abnormally high phenol content can partly compensate, as regards ovicide action, for a deficiency in oils of high boiling point. Baumspritzmittel repeatedly proved more effective than fruit-tree carbolineum against both the eggs and *Anthonomus*. In only one case (with eggs of *B. mori*) did the addition of Bordeaux mixture to Baumspritzmittel prove definitely disadvantageous. In preliminary experiments some mineral oil emulsions proved more efficient against eggs of *B. mori* and *P. mali* than tar oil emulsions.

SPEYER (W.). **Die Empfindlichkeit von Insekten und Insektenlarven gegen Teerölpräparate.** [The Susceptibility of Insects and Insect Larvae to Tar Oil Preparations.]—*NachrBl. dtsch. PflSchDienst* **16** no. 9 pp. 89–92, 6 refs. Berlin, September 1936.

In continuation of previous experiments with tar distillate sprays [*R.A.E.*, A **22** 346], insects and spiders, most of which were collected late in the autumn of 1935 from shelter bands on fruit trees in the Lower Elbe district and kept through the winter in the open, were subjected to spraying from a distance of 2 ins. in March 1936. The soft-skinned larvae of *Cydia pomonella*, L., proved highly resistant [*loc. cit.*], and tar oils are not suitable against them. As both they and the slightly chitinised adults of *Adalia* (*Coccinella*) *bipunctata*, L., proved more resistant than the strongly chitinised adults of *Anthonomus pomorum*, L., and *Bruchus* (*Laria*) *rufimanus*, Boh., it was assumed that tar oils are toxic only if they penetrate the tracheae. The stigmata and organs for closing the tracheae are described for each of the species tested, and it is shown that those most resistant to tar oils (*Cydia* and *Adalia*) have the strongest and most extensive means for closing the entrances to the tracheal system. The adults of the predacious bug, *Anthocoris nemorum*, L., were less resistant than the Coccinellid, but more resistant than a spider of the genus *Clubiona*. Baumspritzmittel were the only form of tar distillate effective against *Anthonomus pomorum*. On the other hand, fruit-tree carbolineums were more effective against eggs of *Cheimatobia brumata*, L., leaf Aphids and *Psylla mali*, Schm., and have the advantage of causing less mortality of Coccinellids, Anthocorids and spiders. The insecticidal effect of Baumspritzmittel was not notably impaired by the addition of a proprietary Bordeaux mixture. As all tar oil preparations, and especially the Baumspritzmittel and the fruit-tree carbolineums of the heavy oil type, alter the biological balance in orchards, they should be used only when really necessary.

LANGENBUCH (R.). **Bericht des Kartoffelkäfer-Abwehrdienstes, Heidelberg.** [Report of the Potato Beetle Defence Service at Heidelberg.] —*NachrBl. dtsch. PflSchDienst* **16** no. 9 pp. 85–87, 2 figs. Berlin, September 1936.

The potato beetle [*Leptinotarsa decemlineata*, Say] has so far been found in 18 localities in the Saar Palatinate and in 8 in southern Rhineland. Surveys are made by search squads working under police regulations. An account is given of the instructional work and of the search service as organised at Heidelberg.

Weitere Kartoffelkäferfunde. [Further Records of the Potato Beetle.] —*NachrBl. dtsch. PflSchDienst* **16** no. 9 pp. 92–93. Berlin, September 1936.

Records are given of further discoveries [*cf. R.A.E.*, A **24** 655] of the potato beetle, *Leptinotarsa decemlineata*, Say, in Germany, made from 21st July to 14th August, in 6 localities at distances ranging up to 18 miles from the French frontier.

Leib (P.). **Zur Frage der Bekämpfung der Pflaumensägewespe.** [The Control of the Plum Sawfly.]—*Anz. Schädlingsk.* **12** no. 9 pp. 101–107. Berlin, 15th September 1936.

In Germany, the plum sawfly [*Hoplocampa minuta*, Christ] is a serious pest of stone-fruits, especially early or mirabelle plums. Control is difficult, as the adults feed only on a little nectar before ovipositing in the calyces and the newly-hatched larvae immediately bore into the fruitlets. The larvae migrate from one fruit to another, however, infesting two or three in the course of their development, and this migration, which may occur over a period of more than 4 weeks, affords an opportunity for control.

A series of spraying tests, here described in detail, were made in the Rhineland. The sprays used were 4 per cent. of a blue dye (acting purely as a repellent) applied in 2 per cent. lime-sulphur on 29th April; 0·4 per cent. derris, applied on 29th April, and 4th and 9th May; and 3 per cent. quassia alone or with 0·5 per cent. soft soap, applied on 9th May. Eggs had been observed in the calyces in examinations at various dates from 8th April to 9th May, and some larvae were seen in the ovaries from 4th to 9th May, mostly on this last date, when more than half the calyces had withered.

The trees sprayed with the blue dye, which withstood heavy showers, were avoided by the sawfly; at least no further oviposition was noticed on them. It is not known if this repellent effect would operate if all the trees were coloured. Quassia alone or with soap gave excellent results, derris, in spite of the three applications, being less satisfactory. The results were estimated by ascertaining the percentages of fruitlets infested on 18th and 29th May.

Gigante (R.). **Una nuova virosi della rosa in Italia.** [A new Virus Disease of the Rose in Italy.]—*Boll. Staz. Pat. veg. Roma* N.S. **16** no. 2 pp. 76–94, 14 figs., 2 pls., 13 refs. Rome, 1936.

A detailed description is given of a virus disease observed in cultivated and hedge roses in Italy in 1936, with brief notes on the differences between it and the two known virus diseases of roses. In cultivated roses the leaves were distorted and blistered, and complete defoliation eventually resulted. The virus was transmitted experimentally by inoculation of infected juice and by Aphids of the genus *Macrosiphum*.

Gigante (R.). **Il mosaico del sedano.** [Celery Mosaic.]—*Boll. Staz. Pat. veg. Roma* N.S. **16** no. 2 pp. 99–114, 11 figs., 1 pl., 20 refs. Rome, 1936.

In 1936, the phytopathological station in Rome received celery plants with leaves distorted and blistered by a mosaic, which is described in detail. In experiments the disease was transmitted by

Cavariella pastinacae, L., an Aphid that was common on infested plants, and also by juice inoculation. It was not carried by the seed or transmitted through the soil. It was transmitted to pumpkin by inoculation and by the Aphid, so that it is possible that pumpkin mosaic [*R.A.E.*, A **23** 185] may be due to the same virus. As healthy celery could be infected by merely lightly stroking the leaves with cotton-wool soaked in infected juice, the virus must be very easily spread in nature. The eradication of a wild host-plant of a celery mosaic in Florida has been advised [**20** 681], and the destruction of wild plants is advocated as a result of the above observations.

Borg (P.). **Report of the Plant Pathologist.**—*Rep. Dep. Agric. Malta 1934–35* pp. liii–lxi. Malta, 1936.

Colonies of *Aphelinus mali*, Hald., introduced from Italy [*cf. R.A.E.*, A **23** 477] for the control of *Eriosoma* [*lanigerum*, Hsm.] on apple, were liberated in 3 districts in Gozo and 5 in Malta in 1934. The parasites were recovered during May–June 1935 from all 3 districts in Gozo and 2 in Malta. On the latter Island, and particularly in the 3 remaining districts, many of them had been destroyed with their hosts at the end of the summer of 1934 by *Coccinella septempunctata*, L., which migrates annually over Malta in a northerly direction at this season. Further liberations were made of parasites collected from the districts where they had survived.

Brief notes are given on a number of Coccids. *Chrysomphalus pinnulifer*, Mask. (*dictyospermi minor*, Berl. & Leon.) on *Citrus* can be controlled by a white oil emulsion applied at intervals of 30 days, and *Aulascaspis pentagona*, Targ., on mulberry and stone-fruit trees by a spray of potassium permanganate [*cf.* **19** 290, 731]. Either of these sprays is effective against *Eriococcus araucariae*, Mask., on *Araucaria*, and *Pseudococcus citri*, Risso (*Dactylopius destructor*, Comst.) and *P. adonidum*, L. (*D. longispinus*, Targ.) on *Citrus*. The last two mealybugs also infest bulbs of *Amaryllis* and *Pancratium*, which may be brushed with a mixture of cresol and methylated spirits. *Ceroplastes rusci*, L., on fig is normally controlled by *Eublemma* (*Thalpochares*) *scitula*, Ramb., but when the latter is scarce the trees should be given a single application of a thick wash of milk of lime.

Ceratitis capitata, Wied., and *C. hispanica*, de Brème, which the author considers distinct from it, caused severe damage to pears and *Citrus* and the later varieties of other fruits. Brief notes are given on control [*cf.* **21** 585]. Promising results were obtained from preliminary trials with baits of fermenting bran and Clensel. *Otiorrhynchus cribricollis*, Gyll., which is not known to breed in Malta but migrates from Sicily in considerable numbers in some years, attacks the young buds of pear and apple. The weevils spend the night on the ground, climb the trunks of the trees in the morning, and drop off them at sunset. They were successfully trapped by adhesive bands. *Rhaphidopalpa* (*Aulacophora*) *foveicollis*, Lucas, which feeds on the leaves of cucurbits, was controlled by the application of a commercial preparation containing sodium fluosilicate. Serious injury to fruit trees is caused by the Longicorn borers, *Cerambyx miles*, Bon., which attacks the trunks of apple and pear, and *Capnodis tenebrionis*, L., which attacks peaches, apricots, nectarines and plums, but not almonds or trees grafted on an almond stock. Infestation by both species may be reduced by painting the bole of the tree up to about $1\frac{1}{2}$ ft. from the

ground with a strong milk of lime in March–April and August–September, when the adults are on the wing.

In experiments in which insects were fed on *Petunia* plants in pots, adults of *Meloë violaceus*, Marsh., and larvae of *Pieris brassicae*, L., and *Diloba coeruleocephala*, L., died immediately after eating the leaves. *Epicometis hirta*, Poda, and *Cetonia aurata*, L., died after eating the leaves, but more quickly after eating the flowers. *Chrysomela americana*, L., was more resistant, but died in 5–6 days after feeding on the leaves, and in 2–3 days after feeding on the flowers.

West (J.). **Leaf Curl of Tobacco in Southern Nigeria.**—*Trop. Agriculture* **13** no. 9 pp. 242–244, 2 pls., 2 figs., 8 refs. Trinidad, September 1936.

At present tobacco is a minor crop in Nigeria, but attempts are being made to extend its cultivation. Leaf-curl was first observed there in 1923; it occurs very rarely in the north and the amount of infection in the south is small. The symptoms observed were greening and thickening of the veins of the older leaves [*cf. R.A.E.*, A **23** 692], cup-like outgrowths on the lower surfaces and a downward curling of the leaves. Infected seedlings never developed, but older plants reached maturity, their flowers showing greening of the smaller veins of the calyx segments. In 1935 an early crop was planted out in June and a late one in August and early September. The early crop was almost entirely destroyed by leaf-curl, while the later one was much less affected. A late crop in another area had an infection of only 1 per cent. The tobacco whitefly [*Bemisia* sp.], which has been shown to be the vector elsewhere [*loc. cit.*], increased in numbers in the area under observation until the end of July, but thereafter became rare. Nurseries sown in June were heavily infested, but infected seedlings were found in only two beds, infection possibly coming from an apparently infected shrub of *Vernonia* sp. (? *amygdalina*) [*cf.* **21** 61] on one side of the nursery. Infected tobacco plants generally had the Aleurodids on them, while healthy plants were free, particularly in the case of the late crop. Conditions later in the season are possibly less favourable for the migration of this whitefly. A series of transmission experiments were carried out. Whiteflies from infected tobacco plants were placed on five tobacco seedlings, which showed greening of the leaf-veins after about 12 days, while at the end of a month symptoms of leaf-curl were observed. Seven control plants remained quite healthy. Attempts to transmit leaf-curl in this way to tomato, chillies [*Capsicum*], *Vernonia* sp. (? *amygdalina*) and *V. tenoreana* were unsuccessful. The best method of control appears to be the existing native practice of growing tobacco in the late rains, which set in in September. By the time of transplanting, the whitefly population has begun to decline and infection is rare, especially if infected seedlings are rejected. If, however, a more intensive cultivation is developed, additional methods [**21** 62] may have to be introduced.

Shafik (M.) & Hindi (A. H.). **Studies on Pyrethrum** (*Chrysanthemum cinerariaefolium* **Trev.**) **in Egypt. I.**—*Bull. Minist. Agric. Egypt* no. 166, 24 pp., 6 pls., 1 fldg map, 37 refs. Cairo, 1936.

The methods of growing pyrethrum (*Chrysanthemum cinerariaefolium*), and the isolation and estimation of the active principles are discussed from the literature. It was first introduced into Egypt in

1918, and experiments on its cultivation in different parts of the country showed that it grows well except in the extreme south and in districts where the water table of the soil is high. Low humidity appears to affect the growth of the plant, and to reduce the pyrethrin content and the number of flowers, and shortage of water during the flowering season appears to diminish the size and weight of the flower-heads. The pyrethrin content of the powdered flower-heads varied from 0·316 to 0·490 per cent. pyrethrin I. In one district the flowers were attacked by *Thrips tabaci*, Lind., *Frankliniella dampfi*, Pries., and *Haplothrips gowdeyi*, Frankl., the first of which caused considerable damage.

GREENAWAY (P. J.). *Mundulea* **Fish Poison.**—*Bull. misc. Inform.* 1936 no. **4** pp. 245–250, 1 pl., 15 refs. London, 1936.

Attention has recently been drawn to the possibility of preparing insecticides from *Mundulea sericea* (*suberosa*) [*cf. R.A.E.*, A **22** 351, etc.]. An account is here given of its botany, ecology, distribution and recorded uses as a poison for fish, etc.

LECOINTE (P.). **Les plantes à rotenone en Amazonie.**—*Rev. Bot. appl.* **16** no. 180 pp. 609–615. Paris, August 1936.

This is a discussion of plants containing rotenone that occur in the forests of Brazil. Figures given showing the rotenone content of some species of the genera *Lonchocarpus*, *Derris* and *Tephrosia* are based chiefly on samples obtained from collectors. The species with the highest rotenone content was *Lonchocarpus nicou* (timbó macaquinho or timbó legitimo), the dried roots of which contain 8–12 per cent. rotenone. Two South American species of *Derris* contain less rotenone than the Asiatic species.

COMPERE (H.). **Notes on the Classification of the Aphelinidae with Descriptions of new Species.**—*Univ. Calif. Publ. Ent.* **6** no. 12 pp. 277–321, 19 figs. Berkeley, Calif., May 1936.

This paper deals with Aphelinids of the genera *Timberlakiella*, *Marlattiella*, *Euxanthellus*, *Aneristus*, *Prococcophagus*, *Coccophagoides*, *Aspidiotiphagus*, *Casca*, *Marietta* (*Paraphytis* [*cf. R.A.E.*, A **14** 42]) and *Eretmocerus*. Keys are given to the females of all these except *Timberlakiella*, which is a new genus erected for *T. applanatonervus*, sp. n., described from females collected in the Philippine Islands, and *Euxanthellus*, which includes a complex of species some of which cannot at present be separated. Twelve new species are described, of which those with specifically identified hosts are *Aneristus brasiliensis* from *Saissetia oleae*, Bern., *Aspidiotiphagus fuscus* from *Chionaspis chaetachmae*, Brain, *A. flavus* from *C. margaritae*, Brain, and *Lepidosaphes* sp., *A. latipennis* from *C. margaritae*, *Chrysomphalus ficus*, Ashm. (*aonidum*, auct.) and *Aspidiotus hederae*, Vall., and *Marietta connecta* from *Tachardina* (*Tachardia*) *actinella*, Ckll. & King, *Pseudococcus filamentosus*, Ckll., *Inglisia elytropappi*, Brain, and *S. oleae*. The first of these is from Brazil, and all the others are from South Africa. The author does not agree with H. L. Dozier, who extended the scope of *Aneristus* to include *Prococcophagus* [**21** 146], and refers to the latter genus *A. hispaniolae*, Dozier, and *A. asterolecanii*, Dozier [*loc. cit.*].

Notice of Permit Requirement for the Entry of Seeds of *Lathyrus* and *Vicia*.—1 p. Washington, D.C., U.S. Dep. Agric. Bur. Ent., 20th July 1936.

Seeds of sweet pea (*Lathyrus* sp.) and vetch (*Vicia* spp.) imported into the United States are frequently infested with various species of *Bruchus*, including *B. brachialis*, Fhr., which is established in only a limited area of the United States [*cf. R.A.E.*, A **24** 293, etc.], and *B. rufipes*, Hbst., and *B. tristiculus*, Fhr., which have not been recorded there. From 1st August 1936 the seeds of all species and varieties of *Lathyrus* and *Vicia* may be imported from any foreign country only under permit, in compliance with the provisions of regulation 3 of Quarantine no. 37 [**14** 162; **24** 746].

Service and Regulatory Announcements April-June 1936.—*S.R.A., B.E.P.Q.* no. 127 pp. 41–93. Washington, D.C., U.S. Dep. Agric., September 1936.

In view of the apparent eradication of the date-palm scale, *Parlatoria blanchardi*, Targ., in those areas in California, Arizona and Texas where interstate movement of date palms and off-shoots has been regulated by Notice of Quarantine no. 6 (which became effective in March 1913) with the amendment issued in 1932 [*R.A.E.*, A **21** 145], this quarantine is revoked from 1st July 1936.

No infestation of cotton by the pink bollworm [*Platyedra gossypiella*, Saund.] occurred during 1935 in the districts of Florida where Quarantine no. 52 is in force against it; consequently baled cotton lint and linters, and products of these produced or manufactured from sterilised cottonseed may now be moved interstate from these areas without first undergoing treatment [*cf.* **21** 145].

Lists are given of bulbs, corms and tubers, and of other articles exempt from requirements of certification under Quarantine no. 48 on account of the Japanese beetle [*Popillia japonica*, Newm.], and plant quarantine restrictions on imports into Argentina, Cyprus, Poland, Antigua, Santo Domingo, Grenada, New Caledonia and Dependencies, Dominica, Portugal, Spain, Austria, France, British India, and Germany are quoted or summarised.

Doane (R. W.), Van Dyke (E. C.), Chamberlin (W. J.) & Burke (H. E.). **Forest Insects. A Textbook for the Use of Students in Forest Schools, Colleges, and Universities, and for Forest Workers.** —Demy 8vo, xii+463 pp., 1 pl., 234 figs., many refs. New York & London, McGraw-Hill Pubg Co., 1936. Price 25*s*.

This text-book deals with insects injurious to forests and forest products that occur in the United States, and the method adopted is to give a fairly full discussion of one or more insects of each representative group and then to list the others with only short comments. Following four general chapters on the importance of forest pests and methods of control, three chapters are devoted to Coleoptera, and others to Lepidoptera, Hymenoptera, Rhynchota, other insect orders and mites, and termites. Each chapter is completed by a list of references. Bark-beetles receive special attention, one of the chapters on Coleoptera and one on control methods being devoted to them. In an

appendix, lists are given of the more important coniferous and hardwood trees of the United States, with some of their principal insect enemies. There is a comprehensive index.

Ficht (G. A.). **The European Corn Borer in Indiana.**—*Bull. Purdue Univ. agric. Exp. Sta.* no. 406, 24 pp., 18 figs., 7 refs. Lafayette, Ind., January 1936. [Recd. September 1936.]

The European corn borer [*Pyrausta nubilalis*, Hb.] was introduced into Indiana in 1926 [*R.A.E.*, A **15** 246], and now occurs over approximately half the State, though infestation of maize is only locally severe. Its rate of increase is largely dependent on the weather, as was shown in June 1934 [**24** 10], when hot dry conditions caused a high mortality. Since it is thought that it may prove to be a serious pest when conditions are favourable, notes are given on its bionomics, with a detailed account of cultural methods of control.

Oosthuizen (M. J.). **The Effect of high Temperature on the Confused Flour Beetle.**—*Tech. Bull. Minn. agric. Exp. Sta.* no. 107, 45 pp., 11 figs., 63 refs. St Paul, Minn., May 1935. [Recd. 1936.]

This is a detailed study of the effects of various temperatures on the death rate of different stages and on the fecundity and fertility of adults of *Tribolium confusum*, Duv., which is an important pest of flour mills and is sometimes controlled by the use of heat [*cf. R.A.E.*, A **23** 328]. The literature is discussed and the technique employed is described. The mortality of all stages in relation to different temperatures and lengths of exposure is shown in numerous graphs and tables. Some of the more important conclusions are as follows: The eggs are killed in less than 3 days at 105°F., and at 100°F. there is a considerable reduction in the percentage that hatch. The relative resistance of different stages can be estimated from the exposures that give 50 per cent. mortality. For eggs these were 14 hours at 111·2°F. and 1·2 hours at 114·8°. For larvae, pupae and adults, respectively, they were 10, 20 and 7 hours at 111·2°, 1, 1·5 and 1·2 hours at 114·8°, 8, 12 and 26 minutes at 118·4°, and 4·7, 4·5 and 4·9 minutes at 122. At 111·2°F. and 114·8°F. the relative humidity was 75 per cent., but at the two higher temperatures it was not controlled. Exposure to 114·8°F. for 2–3 hours at all humidities tested gave 100 per cent. mortality of all stages except the pupae, which required 4 hours at 75 per cent. humidity (at which they were most resistant). In general, dry heat appears to be more effective in killing *T. confusum* than is rather moist hot air at 75 per cent. humidity, although a hot atmosphere saturated with moisture is still more effective. The cause of death by heat is discussed.

The exposure of mature larvae to temperatures of up to 105·8°F. had little effect on the fecundity of the females that developed from them, although long exposures to this maximum temperature resulted in a marked reduction in the numbers of viable eggs produced. In dry air at higher temperatures this was more marked, and practically complete sterility was produced by exposing larvae for 10 hours to 111·2°F. Females developing from pupae exposed for different periods to temperatures of from 98·6 to 100·4°F. with a humidity of 20–25 per cent. were not much affected, but an exposure of 60 hours to a temperature of 104·9–105·8°F. produced sterility in 34 out of 43. Exposures of adult females to heat reduced egg production during and

after the exposure, but this was only temporary. Males were much less susceptible to heat than the females.

Entomology and Zoology.—*Rep. S. Carolina Exp. Sta.* **48** (1934–35) pp. 43–55, 2 figs. Clemson Coll., S.C., December 1935. [Recd. 1936.]

Injury by insect pests was in general somewhat below the average in South Carolina in 1935, but an increase in damage to cotton by *Anthonomus grandis*, Boh., was observed. *Popillia japonica*, Newm., was found in considerable numbers in one district; scattered individuals have been observed in the State since 1931.

O. L. Cartwright reports that studies on the parasites of *Cydia* (*Grapholitha*) *molesta*, Busck [*cf. R.A.E.*, A **23** 657] in 1934 showed that the imported parasite, *Macrocentrus ancylivorus*, Rohw., has become firmly established. In 1935, collections of *C. molesta* from the orchards of Clemson College showed that the percentage parasitised by *Macrocentrus delicatus*, Cress., was 4·6 on 1st June and had risen to 71·4, the highest recorded in South Carolina, by 21st August. Only a single individual each of *M. delicatus* and *M. ancylivorus* had been observed in these orchards in 1931 and none since. *M. delicatus* was also one of the more numerous among 800 parasites of ragweed borers [? *Epiblema strenuana*, Wlk.] reared during 1934. Other parasites reared from ragweed [*Ambrosia*] material included *Glypta rufiscutellaris*, Cress., *Ephialtes* (*Calliephialtes*) *grapholithae*, Cress., and *Eupelmus cyaniceps* var. *cyaniceps*, Ashm., which are known to attack *C. molesta*. Examinations of peach fruits from the Clemson orchards showed the highest injury about 18th July, when 7 per cent. contained larvae. The number of infested twigs rose until 15th June and then remained constant until it fell after 12th August. Examinations of apples showed that 8–15 per cent. contained larvae of *C. molesta* and 4–9 per cent. larvae of the codling moth [*Cydia pomonella*, L.] on 30th July. The corresponding percentages were 5–12 and 5–23 on 25th August, and 2–5 and 4–7 on 6th September. This indicates that *C. molesta* may be responsible for much damage attributed to *C. pomonella*.

Three generations of the rice weevil [*Calandra oryzae*, L.] developed in stored maize between October 1934 and September 1935, the weevils becoming inactive from the end of October until early April, owing to low temperatures. Dusting sulphur at the rate of 2 oz. per bushel in shelled maize in sacks has given excellent control [*cf.* **23** 65], but it was not successful in open bins. Further investigations on *Diatraea crambidoides*, Grote [*cf.* **22** 695] confirmed previous recommendations as to dates of planting maize. Control of *Sphenophorus* (*Calendra*) *callosus*, Ol., was best effected by crop rotation and planting maize early. Observations on egg production showed the maximum to be 281 from one individual between 10th May and 12th September.

J. G. Watts reports that, although *Frankliniella fusca*, Hinds, was more numerous on cotton than in some previous years, *F. tritici*, Fitch, was the most abundant thrips. The peak of the population of *Psallus seriatus*, Reut., came late in August. Infestation in 1935 was slight. *Empoasca fabae*, Harr., was plentiful on cotton in late June and July, but slight injury was done. Cage tests showed a slow leaf malformation and a similar effect was produced by *Graphocephala versuta*, Say. In investigations on *Aphis gossypii*, Glov., it was found that *Lysiphlebus* (*Aphidius*) *testaceipes*, Cress., parasitised more than 75 per cent. 3

weeks after the Aphids became significant on cotton at the college farm. The Pteromalid, *Pachyneuron siphonophorae*, Ashm., was also parasitic on this Aphid, and *Hippodamia convergens*, Guér., and *Chrysopa* spp. were important predators.

F. Sherman and J. N. Todd report that the percentages of adults of the Mexican bean beetle [*Epilachna varivestis*, Muls. (*corrupta*, Muls.)] emerging in hibernation cages in a sheltered wood ravine and in higher open woods averaged 26·35 and 24·85, respectively [*cf.* **23** 658]. A search for the hibernating beetles in the field yielded one individual under oak and pine leaves in an open wood 25 yds. from an early bean row. Adults of *Anthonomus grandis* and *Ceratomegilla fuscilabris*, Muls., were hibernating close by. Experiments in which the larvae or adults of *E. varivestis* were caged on the plants after they had been treated were made to find effective insecticides that would not deposit a harmful residue on the beans. The most effective was a dust of $\frac{3}{4}$ lb. derris root (5 per cent. rotenone) and $4\frac{1}{4}$ lb. talc, which killed 47 per cent. of the larvae and 51 per cent. of the adults, whereas a spray of 2 lb. magnesium arsenate in 50 U.S. gals. water only killed 25 and 28 per cent.

In experiments by Sherman against the tomato fruit worm [*Heliothis armigera*, Hb.], a higher percentage of sound tomatos was given by a spray of lead arsenate in Bordeaux mixture (1 lb. lead arsenate, 3 lb. copper sulphate and 4 lb. lime to 50 U.S. gals. water) than by a dust of 1 lb. calcium arsenate and 5 lb. lime, with or without the addition of 1 lb. sulphur.

Ruhmann (M. H.). **Pests of Cultivated Plants.**—*Hort. Circ. Dep. Agric. B.C.* no. 72 pp. 5–51, illus. Victoria, B.C., 1936.

Hoy (B.). **Sprays and Spraying.**—*Op. cit.* pp. 53–66.

In the first part of this circular, notes are given by Ruhmann on the bionomics and control of a large number of insect pests in British Columbia, almost exclusively those that attack fruit trees, bush-fruits and vegetables. The second part, by Hoy, includes formulae for various insecticides, with notes on their uses, methods of applying them and the cost of the operations.

Russell (T. A.). **The Gladiolus Thrips.**—*Agric. Bull. Bermuda* **15** no. 7 pp. 53–55. Hamilton, July 1936.

The gladiolus thrips [*Taeniothrips simplex*, Morison] has been found twice within a short time on gladiolus corms imported into Bermuda, and from the statement of a florist it seems probable that it caused damage in the Island during 1931. In view of this, a brief description is given of the appearance of infested plants, and control measures [*R.A.E.*, A **24** 248, etc.] are cited.

Insect Pests and their Control.—*Agric. Gaz. N.S.W.* **47** pt. 7 pp. 379–382, 4 figs. Sydney, 1st July 1936.

The pests in New South Wales dealt with in this part of a series [*cf. R.A.E.*, A **24** 446] include the San José scale, *Aonidiella* (*Aspidiotus*) *perniciosa*, Comst., which attacks a variety of deciduous fruit trees [*cf.* **23** 633]. One of its principal natural enemies is stated to be the Aphelinid, *Aspidiotiphagus australiensis*, Gir.

Noble (N. S.). **Fly Parasites of Grasshoppers.**—*Agric. Gaz. N.S.W.* **47** pt. 7 pp. 383–385, 5 figs., 3 refs. Sydney, 1st July 1936.

Dipterous parasites reared from *Chortoicetes terminifera*, Wlk., in New South Wales during the outbreak that occurred in 1934–35 were the Calliphorids, *Locustivora* (*Masicera*) *pachytyli*, Skuse, which predominated, and an undescribed variety of *Helicobia australis*, Johnst. & Tiegs, and the Nemestrinid, *Trichopsidea oestracea*, Westw. The two scavenging flies, *Muscina stabulans*, Fall., and *Sarcophaga depressa*, R.-D., were bred in large numbers from dead and decomposing examples of this grasshopper.

L. pachytyli was bred from grasshoppers collected in most of the infested districts in New South Wales. A remarkable sexual dimorphism was observed in adults of this fly, the males being larger and darker in colour. As many as 4 larvae were often found in a single host, and 70 adults were bred from 42 grasshoppers. The larvae fed mainly in the thoracic region, and when mature ate their way out to pupate in the soil, leaving the grasshoppers to die. The adults were usually attacked, but some larvae were obtained from the hoppers. *T. oestracea*, a rather uncommon species not previously recorded as parasitic on grasshoppers, occurs in various parts of Australia, Tasmania and New Guinea. Brief descriptions of the larva, pupa and adult are given. A similar larva was obtained from *Perelytrana rana*, Sjöst., but it failed to reach the adult stage.

The rate of parasitism of grasshoppers by Diptera is often overestimated because the parasitised individuals are enfeebled and so are collected after the main swarm has resumed its flight.

Ng (Yuk Chau). **A Common Tussock-moth,** *Porthesia* (*Euproctis*) *scintillans* **Wlk. in Canton (Lepidoptera : Lymantriidae.)**—*Lingnan Sci. J.* **15** no. 3 pp. 483–486, 5 figs., 3 refs. Canton, July 1936.

All stages of *Euproctis* (*Porthesia*) *scintillans*, Wlk., are briefly described, its distribution is reviewed, and a list is given of some of its numerous food-plants. It is known as a rather serious pest of castor (*Ricinus communis*) in Malaya. Larvae of different instars have been taken throughout the year on castor, *Capsicum annuum* and other plants in the district round Canton. During May the larvae mature in about 15–20 days. The pupal stage lasts about 5 days in May, 6–10 in October and November, and about 12 in December and January. Adults that emerged on 20th May oviposited and died on 24th May.

Hsiu (Chu-sieh). **The Interrelation of Self-heating of Stored Grain and Granary Pests.** [*In Chinese.*]—*Ent. & Phytopath.* **4** no. 5 pp. 80–83. Hangchow, February 1936. (Abstr. in *Lingnan Sci. J.* **15** no. 3 p. 518. Canton, July 1936.)

The chief pests of stored grain in western Kiangsi are *Rhizopertha dominica*, F., and *Calandra oryzae*, L., but it is also infested by *Tribolium castaneum*, Hbst. (*ferrugineum*, F.), *Tenebroides mauritanicus*, L., *Laemophloeus minutus*, Ol. (*pusillus*, Schönh.), and *Aphomia gularis*, Zell. The author considers that heating of the grain is due either to fungi, excessive moisture, or the presence of insect pests [*cf. R.A.E.*, A **24** 776, etc.], and reviews other theories as to its cause. The heating increases the activity of insect pests and consequently the injury they cause.

Hsu (Fong-kan). **The Red Mites of Tea Plants in Japan.** [*In Chinese.*] —*Ent. & Phytopath.* **4** no. 5 pp. 88–94, 7 figs. Hangchow, February 1936. (Abstr. in *Lingnan Sci. J.* **15** no. 3 p. 518. Canton, July 1936.)

Tea in Japan is attacked by *Tetranychus* sp., which also occurs on other plants, and by *Eriophyes* (*Phyllocoptes*) *carinatus*, Green. Notes are given on their bionomics and control, *E. carinatus* being dealt with much more briefly than the species of *Tetranychus*, all stages of which are described.

Luh (Nien-tsin). **A Survey on the Falling-off of Citrus Fruits due to Insect Pests in Hwangyuen during 1935.** [*In Chinese.*]—*Ent. & Phytopath.* **4** no. 6 pp. 102–107. Hangchow, February 1936. (Abstr. in *Lingnan Sci. J.* **15** no. 3 p. 525. Canton, July 1936.)

Examination of 10,400 *Citrus* trees showed that the fall of fruit was caused by a number of insects, including *Adoxophyes fasciata*, Wlsm., and *Tortrix* (*Cacoecia*) *asiatica*, Wlsm., which bored into the fruits, and *Rhynchocoris humeralis*, Thnb., and ants, which injured them superficially.

Ng (Yuk Chau). **Two Zygaenids,** *Artona funeralis* **Butler and** *Phauda flammans* **Wlk. in Canton.** [*In Chinese.*]—*Ent. & Phytopath.* **4** no. 6 pp. 100–101. Hangchow, February 1936. (Abstr. in *Lingnan Sci. J.* **15** no. 3 p. 528. Canton, July 1936.)

Notes are given on the bionomics of *Artona funeralis*, Btlr., which attacks bamboo, and *Phauda flammans*, Wlk., which is a pest of banyan [*Ficus indica*], and both species are briefly described.

Ng (Yuk Chau). **Four Lepidopterous Pests of** *Crotolaria retusa* **Linn. in Canton, China.** [*In Chinese.*]—*Ent. & Phytopath.* **4** no. 5 pp. 83–88, 3 refs. Hangchow, February 1936. (Abstr. in *Lingnan Sci. J.* **15** no. 3 p. 528. Canton, July 1936.)

In Canton, *Crotolaria retusa* is attacked by *Argina argus*, Koll., *A. cribraria*, Cl., *Utetheisa pulchella*, L., and *Cosmolyce* (*Polyommatus*) *boetica*, L. Notes are given on their distribution, morphology and bionomics ; *A. argus* is the most injurious.

Soong (Chin-chieng). **Notes on the Morphology and Habits of the different Stages of** *Ceracris kiangsu* **Tsai in Hunan (Orth.).** [*In Chinese.*]—*Ent. & Phytopath.* **4** no. 10 pp. 191–198, 4 figs. Hangchow, 1936. (Abstr. in *Lingnan Sci. J.* **15** no. 3 p. 536. Canton, July 1936.)

Descriptions are given of all stages of *Ceracris kiangsu*, Tsai, which is a serious pest of bamboo in Hunan. Larvae of the fourth instar also attack rice, and during migration maize, *Sorghum* and other crops are injured. The bionomics of the different instars are discussed in some detail.

[**Entomology.**]—*Rev. agric. Ops India 1931–32 & 1932–33* pp. 181–209. Delhi, 1936.

The bulk of the information in this review of work in India in 1931–33 has been noticed previously. *Hispa armigera*, Ol., on rice in Burma and Assam was controlled to some extent by removing from the bunds the wild grasses that are its alternative food-plants. Fruit pests observed included *Hypsa ficus*, F., *Perina nuda*, F., and *Ocinara varians*, Wlk., on figs, and *Meridarchis scyrodes*, Meyr., and *Carpomyia vesuviana*, Costa, in fruits of *Zizyphus*, in Madras; and *Indarbela quadrinotata*, Wlk., and *Monochamus versteegi*, Rits., on orange trees in the Central Provinces and Assam, respectively.

A final section deals with the cultivation and natural enemies of the lac insect, *Laccifer lacca*, Kerr.

Mehta (N. C.). **Locusts.**—*Rep. Coun. agric. Res. India 1935–36* pp. 36–39. Delhi, 1936.

The information given on *Schistocerca gregaria*, Forsk., in India has already been noticed [*R.A.E.*, A **24** 236, 443]. As a result of a study of records of *Patanga succincta*, L., the dates of its outbreaks since 1872 are enumerated. There were two great cycles of multiplication, during 1881–84 and 1901–08, since when the species has been quiescent. It has only one generation a year and starts to breed after the beginning of the monsoon rains.

Corbett (G. H.) & Miller (N. C. E.). **The Oriental Migratory Locust (*Locusta migratoria manilensis* Meyen) and the Bombay Locust (*Patanga succincta* L.) in Malaya.**—*Sci. Ser. Dep. Agric. S.S. & F.M.S.* no. 18 15 pp., 18 refs., 1 pl., 2 maps. Kuala Lumpur, 1936. Price 50 *cents*.

The available information on the outbreak of *Locusta migratoria manilensis*, Meyen, in Malaya in 1912–19 is analysed. This species had not been known to occur there prior to 1912, when it appeared near Port Dickson, Negri Sembilan, whence it gradually spread inland. During the outbreak there were many cases of swarms dying off without egg-laying; one such swarm was present in 1916 at Kuchai for 11 months. Successful maturation was apparently prevented by long flights and heavy rains, and the final disappearance of the locusts was probably brought about by unfavourable climatic conditions.

In May 1930, a small swarm of ph. *transiens* was found in the hills in the Tebong District of Negri Sembilan, in an area with coarse granitic sand soil, overgrown with lalang (*Imperata arundinacea*) and scattered bushes, where hoppers had been observed a few weeks earlier. The swarm was treated with poisoned bait, but persisted till the end of June, when the locusts disappeared, without having bred, although individuals from the swarm kept in a laboratory oviposited by the middle of June. It is concluded that since in 1912–19 and again in 1930 *L. m. manilensis* failed to become permanently established in Malaya, not a single individual of ph. *solitaria* having been found there between the outbreaks, the species cannot be indigenous [*cf. R.A.E.*, A **24** 233]. The outbreaks are probably due to immigrants from Borneo or even the Philippines, such migrations being assisted by the north-east monsoon winds prevailing from October to March.

Solitary individuals of *Patanga succincta*, L., have been collected in a number of localities in the central part of the peninsula. Two swarms were observed at Trengganu in 1930 and 1932, damaging hill rice and maize.

Uichanco (L. B.). **Secular Trends of Locust Outbreaks in the Philippines and their apparent Relation with Sunspot Cycles.**—*Philipp. Agric.* **25** no. 4 pp. 321–354, 12 charts, 1 map, 3 pp. refs. Laguna, P.I., September 1936.

The records of the outbreaks of *Locusta migratoria manilensis*, Meyen, in the Philippine Islands, obtained by an exhaustive study of historical documents, are enumerated. They date from 1569, and the average interval between the outbreaks is 11 years. A comparison of these records with sunspot data shows that there is a fairly definite negative correlation between solar activity and locust fluctuations, the outbreaks of the gregarious phase being most widespread in the years when the average sunspot area is 500 millionths or less of the visible solar hemisphere [*cf. R.A.E.*, A **21** 50].

The meteorological stations of the Philippine Islands are divided into three groups, in accordance with the frequency of occurrence of locusts in their area, and Ball-Taylor climatographs of average monthly temperatures and humidities are prepared for each group, for the years of sunspot maxima and minima. Their comparison indicates that the dissimilarities between such years are most pronounced south of 10°N. lat. (Mindanao and the neighbouring islands) where the locust outbreaks are most frequent, and where, during the periods of sunspot minima, the temperature is more uniform than usual throughout the year, and the rainfall is smaller. In the areas north of this latitude, where locusts occur less frequently, conditions are also somewhat drier during sunspot minima, though to a less degree than further south, suggesting that drought conditions are a regular feature of locust years. On the basis of this analysis, it is forecast that 1936 will mark the beginning of the decline of the present cycle of locust infestation in the Philippines.

Lahille (F.). **Hablemos un Poco de Langostas.** [Notes on Locusts.]—31 pp., 4 figs. Buenos Aires, 1936.

This is a popular account of the locust problem in South America, ending with a suggestion for the establishment of a National Locust Institute in Argentina.

Tomasello (J. F.). **Argentine Republic : Locust Invasion during the Years 1935 and 1936.**—*Int. Bull. Plant Prot.* **10** no. 10 p. M217. Rome, October 1936.

The winter swarms of *Schistocerca paranensis*, Burm., overrun the whole of Argentina except Patagonia, but the area actually infested in 1935 only amounted to 192,800 sq. miles. A grant was made for control measures, and the hoppers were controlled by means of barriers, of which about 45 million yards were distributed, and by flame-throwers, sprays and poisoned baits. Damage caused to the principal crops of the country was small, reaching only 10 per cent. even in the case of maize.

JANNONE (G.). **Italy : Numerous Outbreaks of** *Locusta migratoria* **L. ph.** *gregaria* **(Typical) and Phases of Transition in the Province of Naples.**—*Int. Bull. Plant Prot.* **10** no. 10 pp. M218–M219. Rome, October 1936.

Numerous accumulations of *Locusta migratoria*, L., ph. *gregaria*, accompanied by phases *solitaria* and *transiens*, occurred in the summer of 1936 in the north-east, centre and south of Italy, in particular in the province of Naples, where control measures had to be carried out. Breeding took place, and the hoppers apparently hatched about mid-July, for by early September they were reaching the adult stage. Damage was caused to late maize, the fruit of tomatos, and grasses.

CHORBADZHIEV (P.). **The injurious Grasshoppers and other Orthoptera in Bulgaria.** [*In Bulgarian.*]—*Minist. Agric. publ. Dom.* [Publ.] no. 61, 80 pp., 27 figs., 95 refs. Sofia, 1936. (With a Summary in English.)

The available information on injurious Orthoptera in Bulgaria is summarised, and the outbreaks of Tettigoniids and Acridids since 1890 are enumerated. Descriptions and outlines of the life-history of the known species are given, as well as a key to the genera of the Acridids. *Dociostaurus maroccanus*, Thnb., and *Calliptamus italicus*, L., are the most injurious, the former occurring throughout the country, and the latter mainly in the west and south-west. They damage spring-sown cereals, as well as forage crops and vegetables. The solitary phase of *Locusta migratoria*, L., is sometimes found, but the gregarious phase, swarms of which used to invade Bulgaria from the Danube delta, has not appeared for the last ten years. The main factors limiting the abundance of locusts in Bulgaria are the fungus, *Empusa grylli*, which often causes epidemics among *D. maroccanus* and *C. italicus*, starlings (*Pastor roseus* and *Sturnus vulgaris*) and storks (*Ciconia alba*).

The Tettigoniids, *Isophya amplipennis*, Brun., *Poecilimon brunneri*, Friv., and *P. thoracicus*, Fieb., occasionally appear in large numbers in forested regions in eastern Bulgaria. All three attack deciduous forest trees and tobacco, and *Isophya* is also injurious to pears, plums, vines and vegetables. Of the Gryllids, *Gryllulus* (*Gryllus*) *desertus*, Pall., and particularly *Gryllotalpa* (*Curtilla*) *gryllotalpa*, L., damage various vegetables.

An account of the usual mechanical and chemical methods of control is included.

SEITNER (M.). *Lachnus cembrae* **n. sp. Die Zirbenblattlaus.** [The Cembran Pine Leaf Aphid.]—*Zbl. Forstwes.* **62** no. 2 pp. 33–49, 8 figs. Vienna, February 1936. [Recd. October 1936.]

The fundatrix, winged migrant and sexuales of *Cinara* (*Lachnus*) *cembrae*, sp. n., are described from *Pinus cembra* in the Austrian Alps. The Aphids of this genus are each confined to a single species of food-plant, though the winged forms migrate from one tree to another. Starting from the fundatrices that hatch from the overwintered eggs, there are four consecutive parthenogenetic viviparous generations, of which the last comprises the sexuparae. These produce the sexuales, which mate and oviposit in autumn. Oviposition by *C. cembrae* began towards the end of August and lasted well into September. A female is

able to lay up to 16 eggs. Eggs kept indoors at 5–8°C. [41–46·4°F.] hatched in mid-March. In nature at an altitude of about 5,600 ft., many unhatched eggs were observed on 25th May 1930, together with young fundatrix larvae ; the winter had been severe, with about 5 ft. of snow in February and March. Ants were closely associated with this Aphid. It was parasitised by *Aphidius pini*, Hal., and less frequently by another species, here described by Fahringer as *A. aterrimus*, sp. n. Predacious enemies included the Syrphids, *Syrphus* (*Epistrophe*) *vittiger*, Zett., *Platychirus peltatus*, Mg., and *Didea alneti*, Fall. The Aphid occurs on those parts of the tree that are from 3 to 15 years old. The effect on the plant tissues of its feeding is described. The direct economic importance of the injury is negligible, but it may possibly encourage secondary pests.

VON TUBEUF [C.]. **Die Ulmenkrankheit in München im Sommer 1936.** [Elm Disease in Munich in the Summer of 1936.]—*Z. PflKrankh.* **46** no. 10 pp. 484–507, 22 figs. Stuttgart, 1936.

An account is given of a severe outbreak of Dutch elm disease on *Ulmus procera* (*campestris*) and *U. glabra* (*montana*) in Munich in 1936, together with a summary of Spessivtseff's paper on feeding by young adult bark-beetles [*R.A.E.*, A **10** 149] and a list of the bark-beetles that have been recorded on elms in Germany.

ÖRÖSI-PÁL (*Z.*). **Ergänzende Untersuchung über die Entwicklung der äusserlichen** *Acarapis***milben der Honigbienen.** [Completion of the Investigation on the Development of the external *Acarapis* Mite of the Honey Bee.]—*Z. Parasitenk.* **8** no. 5 pp. 617–618, 1 ref. Berlin, 3rd August 1936.

Further observations on the external form of *Acarapis* [*woodi*, Rennie] infesting honey bees in Germany [*cf. R.A.E.*, A **23** 66] demonstrated the occurence of a free-living eight-legged nymph.

TITSCHACK (E.). **Experimentelle Untersuchungen über den Einfluss der Massenzucht auf das Einzeltier.** [Experimental Investigations on the Effect of Mass-breeding on the individual Insect.]—*Z. angew. Ent.* **23** no. 1 pp. 1–64, 8 graphs, 3 pp. refs. Berlin, April 1936. [Recd. October 1936.]

This is a detailed study of the influence of an increase of population on an insect, made by rearing larvae of the clothes moth, *Tineola biselliella*, Humm., singly or in batches of 25, 50, 100, 500 and 1,000 in dishes, and ascertaining the weight and length of the newly emerged adults. The technique employed is described. The following is taken from the summary. Amounts of food that were inadequate for the complete development of a larva when it was bred singly were sufficient when it was one of a large population. Males predominated when food was scarce, and females when it was abundant. With abundant food the females had a longer emergence period than the males ; this was not always the case with scanty food and overpopulation. With an increase of food shortage and also of overpopulation, the interval between the emergence of the sexes decreased ; in bad conditions both sexes emerged on the same day, thus ensuring pairing before death.

Buhl (C.). **Beiträge zur Kenntnis der Biologie, wirtschaftlichen Bedeutung und Bekämpfung von *Kakothrips robustus* Uz.** [Contributions to the Knowledge of the Biology, economic Importance and Control of *K. pisivorus*, Westw.]—*Z. angew. Ent.* **23** no. 1 pp. 65–113, 21 figs., 3 pp. refs. Berlin, April 1936. [Recd. October 1936.]

A detailed account is given of field and laboratory observations on *Kakothrips pisivorus*, Westw. (*robustus*, Uzel) made in 1932–34 near Kiel, North Germany, where it is a serious pest of peas. The eggs are laid in the tissues of the food-plant, and the larvae feed for about a fortnight. They then enter the soil and remain in a diapause for about 10 months. The prepupal and pupal stages follow, and the adult rests for 2 days before emerging from the ground and then has a pre-oviposition period believed to last 7–13 days.

The duration of the egg stage averaged a week. Larvae were seen from 10th June to 29th July in 1933 and from 8th June to 6th August in 1934. They have two instars, and in the laboratory completed the first in an average of 6 days and entered the soil a week later. They occurred in the ground at depths of 2–16 inches, usually 8–14. In the field the prepupal stage began in the second half of May and averaged 5 days at 18–21°C. [64·4–69·8°F.], the pupal stage averaging 7 days. In the laboratory the average life of the male was 25 days and of the female 27, but an adult life of 14 days is believed to be usual in nature. The adults were comparatively active in flight and can probably cover long distances in calm weather or with the wind. Females laid an average of 17 eggs at the rate of 1–4 per day.

During the observations, the adults first flew to horse beans, but most of them migrated to peas for reproduction. The chief plants infested were *Pisum sativum* and *Vicia faba*, but breeding was also observed on a number of other Leguminosae. The adults fed on the young shoots and blossoms of the peas, and the larvae on the pods. The crop loss is greatest in late varieties and may amount to 50–60 per cent. No damage was observed on *Vicia faba*. A comparison is made between the conditions of the district near Kiel, where injury is severe, and that near Aschersleben, Saxony, where it is negligible. Kiel has a moist, Atlantic climate, while Aschersleben is distinctly dry and warm. In the former district the proportion of females to males was 2·5–3·6 to 1, while in the latter it was 10·6–41·2 to 1. Near Kiel the adults emerged suddenly at the time when the peas were blossoming, whereas near Aschersleben they emerged gradually and did not become very abundant until the late varieties were already past full bloom.

Natural enemies observed included the Eulophid, *Thripoctenus brui*, Vuillet, which oviposited in larvae of both the first and second instar. The larvae showed no external sign of parasitism until they had migrated to the soil, but then entered the prepupal stage in as short a time as 2–3 weeks. The egg and larval stages of the parasite were completed in 16–27 days, and it then remained in the pupal stage for about 11 months, the adult emerging from the ground in mid-June. In the laboratory, females lived for 1–8 days. No males were observed, though 1,452 adults were examined. The degree of parasitism was not high enough to be of importance in control. The larvae of *K. pisivorus* were also destroyed by predators, including the mite, *Anystis baccarum*, L., Cecidomyiids and birds, but climate is believed to be the chief factor

controlling it. Direct measures against it are not feasible, but indirect measures include selection of early varieties of peas, crop rotation, and temporary prohibition of the growing of leguminous plants where injury is severe.

Schedl (K. E.). **Populationsregulatoren und ihre Wechselbeziehungen bei Borkenkäfern.** [The Factors regulating Population and their Correlation in Bark-beetles.]—*Z. angew. Ent.* **23** no. 1 pp. 149–173, 9 graphs, 5 refs. Berlin, April 1936. [Recd. October 1936.]

This is a discussion of papers by Seitner [*R.A.E.*, A **12** 297], Golovyanko [**14** 208], Il'inskiĭ [**17** 145] and Trägårdh & von Butovitsch [**23** 222] on the factors governing outbreaks of bark-beetles in forests and on the possibility of expressing these factors by mathematical formulae to indicate prospects of infestation.

Kunike (G.). **Zur Veröffentlichung von B. Germar : Versuche zur Bekämpfung des Kornkäfers mit Staubmitteln. Eine Stellungnahme.** [Regarding B. Germar's Paper : Experiments against the Grain Weevil with Dust Insecticides. A Criticism.]—*Z. angew. Ent.* **23** no. 1 pp. 174–176. Berlin, April 1936. [Recd. October 1936.]

Germar (B.). **Erwiderung auf die Stellungnahme von Dr. Kunike zu dem Aufsatz : "Versuche zur Bekämpfung des Kornkäfers mit Staubmitteln."** [A Reply to Dr. Kunike's Criticism.]—*T.c.* no. 2 pp. 327–329. Berlin, July 1936.

The first article is a criticism of a paper reporting successful results in Germany against *Calandra granaria*, L., with "Naaki," a proprietary powder of silicic acid [*R.A.E.*, A **24** 341]. It is pointed out that various German authorities tested this material with inadequate results and that Germar did not prove its efficiency with the large quantities of grain usual in practice.

In the second article various statements in the first are disputed.

Bouwman (B. E.). **Het klopkevertje en zijn parasiet.** [*Anobium punctatum* and its Parasite.]—*Levende Natuur* **41** no. 6 pp. 161–165, 8 figs. Amsterdam, 1st October 1936.

A description is given of the act of oviposition by the Braconid, *Spathius exarator*, L., in the wood of an elm board infested by the larvae of *Anobium punctatum*, DeG. (*striatum*, Ol.) in Holland.

Kawecki (Z.). **Blutlaus und Blutlauszehrwespe in Süd-Polen.** [The Woolly Aphis and its Parasite in South Poland.] [*In Polish.*]—*Ogrodnictwo* 1936 fasc. 1 reprint 29 pp., 7 figs., 2 graphs, 1 map, 33 refs. Kraków, 1936. (With a Summary in German.)

Eriosoma lanigerum, Hsm., is an important pest of apple in south-western Poland. Its local distribution is discussed, and a brief account of its life-history is given from the literature. Apple is the only plant infested in Poland and the winter is usually passed in the larval stage, but it has been found by K. Simm that hibernation in the egg stage may also be of significance. His observations were published in a monograph ("Korówka wełnista (*Schizoneura lanigera* Hausm.).

Studja nad biologją." Kraków, nakł. Tow. Ogrodn. w. Krakowie, 1927) that has escaped the attention of most workers. He found that fundatrices hatch in May or June from eggs laid in the previous autumn. They produce larvae parthenogenetically, and these are the beginning of a series of generations produced throughout the warm season of the year. Winged forms appear from the end of June till late autumn and some of these fly to other trees, even if they are a considerable distance away. The winged forms that appear before mid-July produce parthenogenetic offspring, but those that appear later are sexuparae and fly to the final food-plant where they give rise to a few (about 20) live larvae without a proboscis [*cf. R.A.E.*, A **14** 221]. These are the sexuales ; the fertilised females lay one winter egg each, from which the fundatrix hatches in the following spring. Simm found the winter eggs in the field in the second half of October in cracks of the bark on thin twigs, but never on the leaves. The resistance of the eggs to fluctuations of temperature was demonstrated in laboratory experiments, in which they survived after having been exposed to —8°C. [17·6°F.] and then to 18°C. [64·4°F.], and eventually hatched. The reproduction of the fundatrices on apple affords support to the view that the woolly Aphid that migrates to American elm in the United States is not *E. lanigerum* [**20** 442].

Parasitism of *E. lanigerum* by *Aphelinus mali*, Hald., was first observed in Poland in 1935 [**24** 655, etc.]. The distribution of the parasite in the different districts is discussed, and it is suggested that it should be reared for liberation in localities in which it does not yet occur.

Meier (K.). **Bericht der Eidgenössischen Versuchsanstalt für Obst-, Wein- und Gartenbau in Wädenswil für die Jahre 1931–1934.** [Report of the Swiss Federal Experiment Institute for Fruit, Vine and Garden Cultivation at Wädenswil for 1931–34.]—*Landw. Jahrb. Schweiz* **50** no. 6 pp. 569–605, 3 figs. Bern, 1936.

This report includes summaries by various authors on their work on insect pests of fruit trees, some of which has already been noticed [*R.A.E.*, A **21** 58, 681 ; **22** 246, 433, 612]. K. Meier points out that the cherry fly, *Rhagoletis cerasi*, L., does not occur in some parts of Switzerland and causes severe losses in others. R. Menzel reports that the cherry blossom moth, *Argyresthia ephippella*, F., began its main flight in mid-June in 1933 and at the end of May in 1934 and ended it in October. The eggs were laid under bark scales or in cracks in the bark, between the buds or even under the bud scales, so that a powerful spray of 5 per cent. fruit-tree carbolineum is necessary to kill them. As a supplementary treatment, a spray of calcium arsenate or lead arsenate when the buds are swelling is of value. In spraying experiments on apple, Menzel found arsenicals to be superior to nicotine or summer oil against *Cydia pomonella*, L., *Cheimatobia brumata*, L., and *Hyponomeuta padellus malinellus*, Zell. Good results against leaf Aphids were obtained by using nicotine in the pre-blossom spray.

R. Wiesmann states that 100 per cent. mortality of *Aonidiella* (*Aspidiotus*) *perniciosa*, Comst., on imported apples in barrels and boxes was obtained by fumigation for 4 hours with hydrocyanic acid gas at the rate of 0·4–0·5 volumes per cent., and that this concentration did not injure apples or pears.

Faes (H.). **La préservation des plantes cultivées. D'une part, par la protection des auxiliares naturels : d'autre part, par l'élevage et la multiplication d'animaux et végétaux ennemis des déprédateurs et parasites.**—*Landw. Jahrb. Schweiz* **50** no. 7 pp. 759–773. Bern, 1936. (With a Summary in German.)

The author discusses the value against insect pests of insectivorous vertebrates, and of insects, fungi, and bacteria, either indigenous or imported. He concludes that indigenous species are influenced chiefly by local climatic conditions and that no artificial aid will increase their efficiency to a practical extent. Imported enemies may be of value, but their effect will always be incomplete as they cannot thrive in the absence of their hosts.

Pohjakallio (O.). **Valkotähkäisyystutkimuksia Jokioisissa kesällä 1935.** [Investigations on White Ear made in Jokioinen in the Summer of 1935.]—*Valt. Maatalousk. Julk.* no. 77, 78 pp., 19 figs., 4 pp. refs. Helsinki, 1936. (With a Summary in German.)

Investigations at Jokioinen, Finland, led to the conclusion that "white ear" in cereals and grasses results from lack of water and nutriment, insufficient sunshine, and various injuries to the stems [*cf. R.A.E.*, A **24** 262, 623], as well as from infestation by thrips and mites. These may sometimes occur in numbers on grasses without causing white ear.

[Mel'nichenko (A. N.).] **Мельниченко (А. Н.). Regularities of Mass Flying of the Adults of *Loxostege sticticalis* L. and the Problem of the Prognosis of their Flight Migrations.** [*In Russian.*]—*Bull. Plant Prot.* (1, Ent.) no. 17, 56 pp., 8 figs, 14 refs. Leningrad, 1936. (With a Summary in English.)

With a view to studying the laws that govern migrations of adults of *Loxostege sticticalis*, L., systematic observations on their flight were carried out in the Aktyubinsk district in north-western Kazakstan in July–August 1934. Theories on the causes of the mass-appearance of the moths are briefly reviewed from the Russian literature [*R.A.E.*, A **22** 373, 467, etc.]. The sudden appearance of swarms in the Aktyubinsk district in the beginning of June 1934 was probably due to their migration from the adjoining Department of Kuïbuishev (Samara), where large numbers of hibernating larvae had occurred, the moths having thus covered distances of 125–155 miles. The resulting larvae were exceedingly abundant and destroyed all kinds of vegetation in the steppe, but did comparatively little damage to cultivated vegetables. The adults of the first generation, which were present in great numbers, were on the wing in the second half of July, but in only 5–10 per cent. of the females were the ovaries even partly developed. No migrating swarms of females that were fully mature or that had oviposited were observed.

The author concludes from his investigations, which are discussed in detail, that the flight of the moths, which chiefly begins at dusk, is closely connected with the temperature inversion of the air. During the period of sexual maturation, the moths require a certain amount of warmth, the optimum temperature being 25–28°C. [77–82·4°F.], and as at dusk and in the evening the temperature is warmer at a height of 23–26 ft. than near the ground, they fly up and are then carried by the

warm air currents. At first they fly horizontally, but as the night advances and the inversion of the air temperature increases, they rise higher, so that by morning they have reached an altitude of 250–330 ft. They usually fly up in largest numbers when the temperature is about 15°C. [59°F.] 4 ins. above the ground and 20°C. [68°F.] at a height of $6\frac{1}{2}$ ft. They cease to fly up when the temperature at these heights falls to about 12 and 16°C. [53·6 and 60·8°F.], respectively. About 45 per cent. of the migrating moths (those that fly comparatively low) alight during the first half of the night, having covered distances that vary from several yards to several miles ; they do so, however, only before the period when the temperature near the ground falls to the limits at which moths cease to fly up. Moreover, they apparently alight only if the place is suitable, as they invariably congregate on flowering plants, and have never been observed in dry steppe, or on plots on which the vegetation has been destroyed by the larvae. The rest of the moths do not alight during the night, but are carried by the warm air currents at an altitude of 160–250 ft. until the morning. By noon they begin to descend to the ground, this being probably connected with the cessation of the night inversion of temperature after sunrise. Most of them, however, do not alight, but continue to move on. Diurnal rises and flights of the moths, which often occur about noon and particularly in hot weather, are always connected with the convection currents of the air. As a rule, the moths do not rise at the approach of a thunder cloud, when there is a sudden fall in temperature and the wind increases. Comparatively small swarms, however, fly up during the day, and they only supplement the enormous numbers that are already in flight. The moths are active in flying up, both at dusk and at noon, but are semi-passive in the air currents, with which their direction and speed of migration practically coincide. They move at an average rate of 10 miles an hour, and have been shown to cover 120–180 miles a day. The flights take place within the system of winds of the warm sector of a cyclone, and the bulk of the moths alight in the rear of a cyclone, where as a rule prolonged rainfall occurs and prevents further migration. Under these conditions the vegetation is abundant, and the maturation of the moths, oviposition and the development of the resulting larvae are secured.

Observations on the reaction of the moths to light showed that they are negatively phototropic at most temperatures and only positively phototropic when the temperature at the level of the flight is below 22°C. [71·6°F.] and above 19°C. [66·2°F.]. Light-traps are, therefore, useless for control.

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CONTENTS.

CONTENTS—*cont.*

CONTENTS—*cont.*

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